RAILROAD GAZETTE

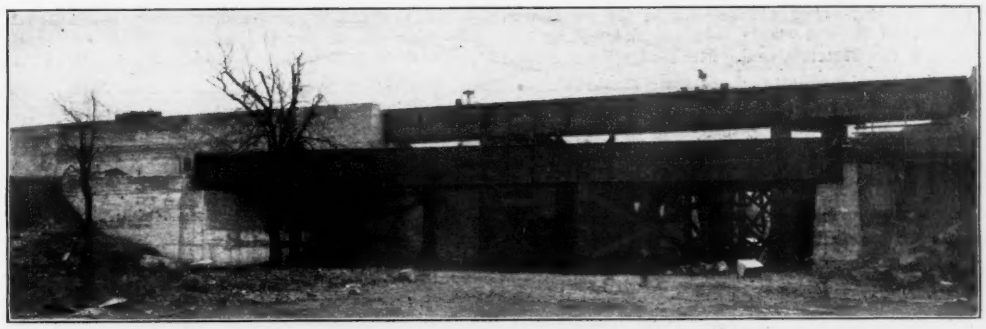
FRIDAY, NOVEMBER 27, 1903.

CONTENTS

Delaware, Lackawanna & Western Track Elevation in Newark and Harrison, N. J.

This is probably the most important of the many improvements which have been in progress on the D., L. & W. since the new management took control of the road in 1899. When completed, all of the nine grade crossings in Harrison and 26 in Newark which exist on the present line will be eliminated and the maximum grade of 2.6 per cent. will have been reduced to 1.15 per cent. A few slight changes in alinement and the relocation of the passenger station and freight house have also been made. Work was started early in 1902 and it is expected that the improvements with one exception, which will be referred to later, will be completed and all trains running over the new tracks by June, 1905.

The work is divided into two parts, the elevation of the tracks through Harrison to High street, Newark, and the depression of the tracks from that point west to the city limits beyond the Roseville avenue station. The track elevation begins at a point 2,658 ft. east of Seventh street, Harrison. The present double-track line rises from here to the Passaic river on a .95 per cent. grade, but the new line, which will be three-track, rises on a 1 per cent. grade to Fourth street, and from there to Sussex street on a .5 per cent. grade, where it is run on a level to Harrison avenue. The change in alinement from the present tracks is very slight, at no place being more than 15 ft. from the old location.

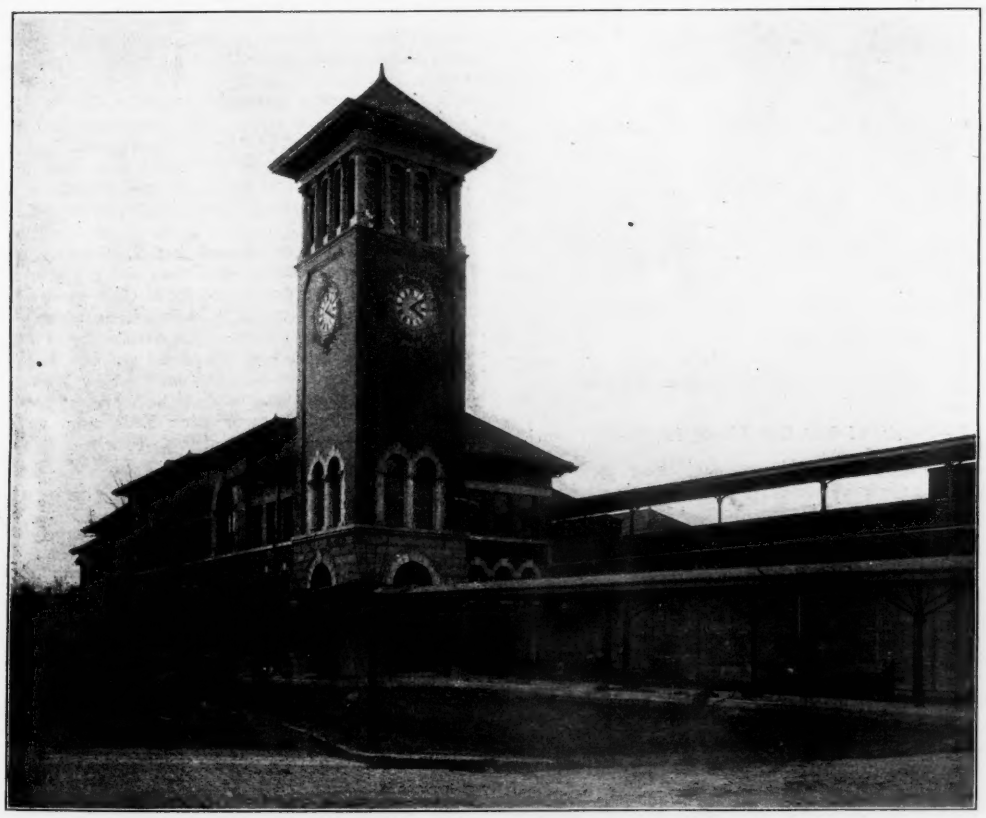


Overhead Crossing at Cleveland Avenue, Harrison, Showing Concrete Retaining Walls.

Steelwork in Newark Approach to Draw Bridge over the Passaic River.

At Harrison avenue the two south tracks, which will be used for passenger trains, begin to rise on a 1 per cent. grade, and the north track, which is to be used as a freight track into the Newark yard, begins to descend on the same grade. At Passaic avenue, where the lines run on the double-deck draw bridge over the river, the freight track turns under the passenger tracks above and runs over the lower deck of the draw. The photograph of the crossing over Cleveland avenue shows the difference of level of the tracks at that point, which is about 6 ft.

The location of the new line where it crosses the river is 35 ft. north of the present bridge. The draw span which is now in use will be floated up-stream when the new line is completed and lowered on a new pier which has been built. This span was erected in April, 1901, to replace an old light structure which was too weak for the traffic which was passing over it. At that time the other improvements in Harrison and Newark were under preparation and the bridge was designed as a double-deck span for the heaviest traffic, so that it might be transferred from its temporary position when the improvements were completed. It is arranged for two tracks on the upper deck, 21 ft. above the lower deck, which is intended for a single track only. When moved up-stream it will at the same time be lowered 10 ft. 6 in. to the level of the new line. The maximum elevation above the present tracks in Harrison is about 17 ft.



New Passenger Station at Plane Street, Newark.

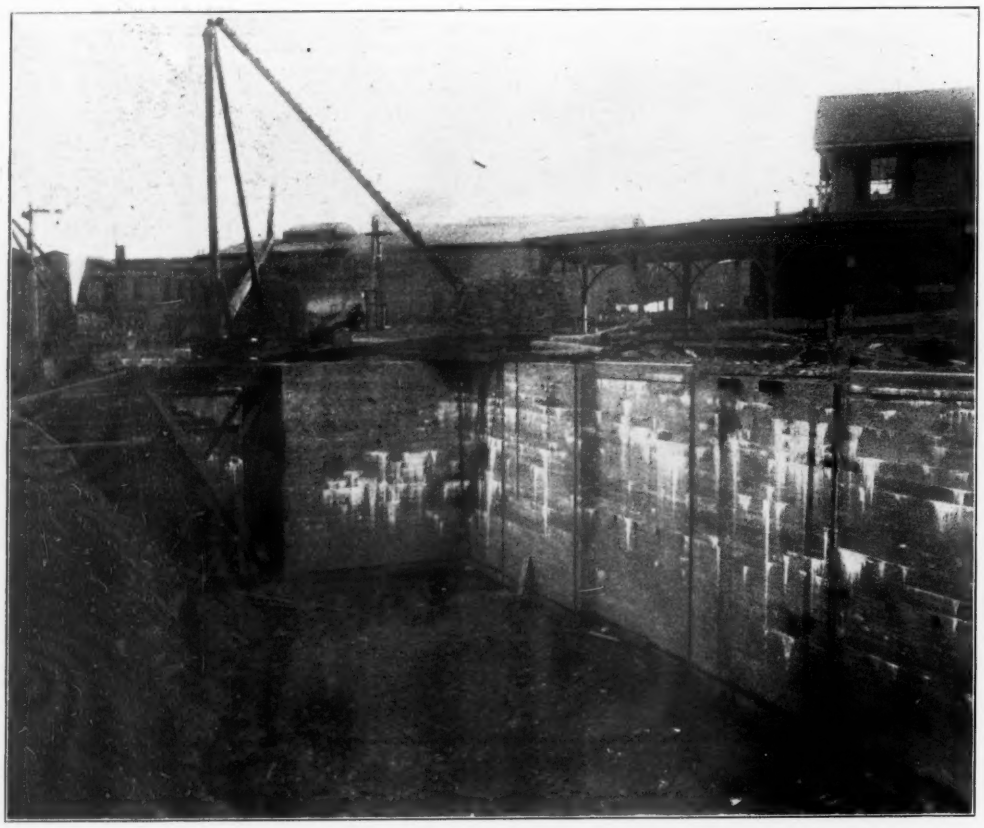
Between the new passenger station at Newark and the river, the two passenger tracks will be carried on a heavy plate girder steel structure shown in the illustration. The freight track will be carried into the new yard on the level with the present main line tracks. After passing the bridge the old line curves south to the Broad street station and then turns north again a little beyond the station. The new alinement carries the track over Broad street about 285 ft. north of the present station and eliminates the curve after crossing the bridge.

The new station is located on Plane street and is a handsome building of pressed brick and stone. There are three tracks with cement platforms and umbrella sheds. Concrete retaining walls have been built to support the tracks at this point and beyond on both sides. The average grade between the draw bridge and High street to the west is .65 per cent. rising from the bridge. The freight house, which is a two-story brick building, is located on the east side of Broad street just south of the elevated tracks. The land to the south now occupied by the main line will be utilized for a freight yard.

The line from the new station west is almost straight, intersecting the present line at grade near High street. From this point on out beyond the Roseville avenue station the new location will be inside the old right-of-way but a few feet north of the old tracks. West of High street about 400 ft., cutting begins and continues to the city limits. The average depression will be about 20 ft. and the present grade of 2.6 per cent. will be reduced to 1.14 per cent. Nothing has been done on the section between High street and the Morris Canal because the depressed tracks as planned will be below the level of the canal which must be abandoned before the work can be completed. The charter of the canal company carries with it many property rights and privileges, and the Lehigh Valley, which at present operates it, would lose much valuable dock and terminal property were it abandoned and the charter annulled. Negotiations are now in progress, however, and as soon as the damages can be agreed upon the canal will be closed and the depression of the tracks completed. Meanwhile the work west of the canal will be completed and trains run over the old line from High street, where the new line joins on, to a point west of the canal, where a temporary grade of 1.5 per cent. will carry the tracks down to the new level again.

The cut west of the canal is wide enough for three tracks and concrete retaining walls are used on both sides of the excavation. Steel highway bridges will carry the streets over the cut. The work has been carried on without interfering with the heavy traffic which passes over the present line in any way. Trenches were dug on both sides of the tracks just wide enough to build up the concrete retaining walls, the tracks being shifted north or south as the work required. These walls are now completed for nearly the entire length of the improvement, leaving a core of earth between them on which the tracks rested. The tracks were then moved to the south far enough to excavate a part of the core to the new grade

wide enough for two tracks. This part of the work is now being done and when completed a two-track trestle will be built in the excavation and the tracks shifted north on it. The remaining part of the core will then be excavated and two tracks laid on the new grade, over which the trains will be run while the trestle is being dismantled. The third track will be laid when the cut is cleared of timbering. A number of sewers are cut through by this work and to take care of the sewage a large intercepting sewer will be built in the south wall of the cut which will empty into an intercepting city sewer near the Morris Canal. Much of the excavation



Concrete Walled Excavation for New Station at Roseville Avenue, Newark.

in the bottom of the cut is rock, which has made the work particularly difficult and expensive.

The new station at Roseville avenue will have the platforms about 26 ft. below the street level. The station building will be on the Montclair branch line just beyond the junction with the Morris & Essex branch, but the platforms will be connected and both lines will use the one station building. Stairways from the street will lead down to the platform levels. The photograph shows the present appearance of the station site at this point.

The Morris & Essex line rises from the Roseville avenue station on a 1.15 per cent. grade and emerges to the present level just beyond the city limits. A new station has just been built at Grove street, East Orange, and the line must be on the surface before the station is reached. The Montclair branch is nearly level from the Roseville avenue station on out to a point between Fourth and Fifth avenues, where it strikes the present line and continues on out on the same grades.

The total length of the improvement is about 3½ miles, divided into 1.6 miles of elevation and 1.9 miles of depression. The elevation in Harrison will probably be completed about the first of the year and the draw bridge moved at that time. The new station at Plane street is finished and ready for use as soon as the trains run over the new bridge. The work on the depression is not so far advanced and trains will probably not be run on the new level west of the Morris Canal until June, 1904.

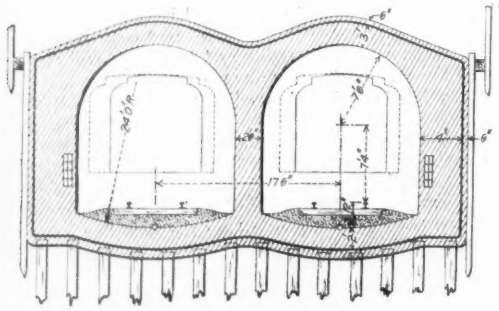


Fig. 4.—Section of Double-Arch Tunnel.

It will be June, 1905, before all of the work in that section is finally completed. The work will cost about $3,000,000. A complete account of this and other improvements made on the Delaware, Lackawanna & Western since the inauguration of the present management in 1899 was given in the *Railroad Gazette*, Nov. 14, 1902.

In Germany it has become common to bolt plates of hard wood on the face of ties of softer wood, as a sort of "chair" to prevent the mechanical destruction of the tie, and machines are used for the purpose. A very great advantage is claimed for this method. The ties on the military railroad where the great speeds were obtained are of this kind.

Hudson River Tunnel of the New York & Jersey Railroad.

The past history of the tunnel which the New York & Jersey Railroad is now building under the Hudson River has been one of varying fortunes. The idea was first proposed in 1874 when the Hudson Tunnel Ry. Company was organized to build a tunnel from Jersey City to New York. The plan then called for two tunnels large enough to convey all passenger trains from the West through Jersey City direct to New York without change.

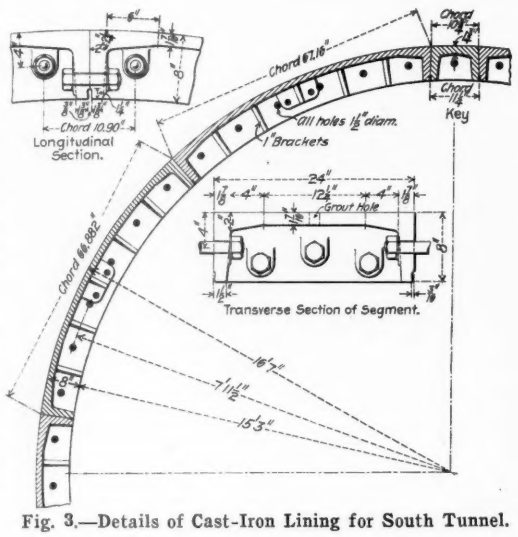
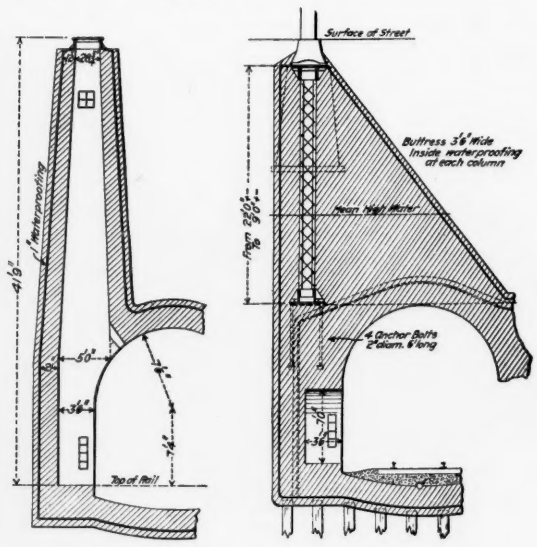


Fig. 3.—Details of Cast-Iron Lining for South Tunnel.

Soon after the incorporation of the company, a shaft was sunk on the Jersey side of the river, but work was almost immediately held up by an injunction brought by the Delaware, Lackawanna & Western, on the ground that the excavations were being made on property owned by the railroad company. After several years of legal controversy a settlement was finally made, and borings for an 18 ft. tunnel were resumed in 1879. This work was continued until 1882, when through lack of funds the company was again forced to suspend operations. From 1882 until 1889 nothing was done, but in August, 1889, English engineers became interested and the firm of S. Pearson & Son undertook to complete the tunnel.

The original method of excavation was to work the opening at the head of the tunnel in a terraced form without the use of a shield and to brick up the walls as fast as the heading advanced, the air pressure in the tunnel being retained by the impervious nature of the silt through which the boring was done. A number of serious accidents causing great loss of life and suspension of work for long periods occurred with this method, due to the air pressure leaking off through the porous brick lining and in two or three cases because of the blowing out of the earth at the head of the tunnel. When S. Pearson & Son took up the work it was decided to adopt the Greathead shield system for advancing the boring and a shield 19 ft. 5¼ in. in diameter, made by Messrs. Arrol & Co., of Glasgow, was introduced in the north tunnel and instead of brick walls, cast iron segmented rings were substituted for the tunnel lining. The excavations were carried on under the new system without mishap until July, 1891. Then the funds gave out and the tunnel was again abandoned. About 4,000 ft. of the north tunnel and 600 ft. of the south tunnel had been completed from the Jersey side, but little work had been done on either tunnel from the New York end. A brick bulkhead was built up back of the shield which was left under the river and the air pressure was removed from the workings.

In February, 1902, the New York & Jersey Railroad Company was organized, with W. G. McAdoo as President and Chas. M. Jacobs as Chief Engineer. This company succeeded to the properties and franchises of the Hudson Tunnel Ry. Co. Plans were immediately made to finish the two tunnels so as to provide an entrance into New York for the electric street and suburban car lines in Jersey City and Hoboken. A terminal property was secured at Christopher and Greenwich streets in New York, giving connection with many of the surface lines and with the Ninth avenue line of the Manhattan Elevated.



Figs. 5 and 6.—Manhole and Elevated Railroad Supporting Column Construction.

The location of the two tunnels is shown in the plan, Fig. 1. The Jersey City terminal is to be at Henderson and 14th streets. From there the line runs under the yards of the Delaware, Lackawanna & Western to the river and then across to a point just south of Morton street. It will run under Morton street to Greenwich street, where it turns north on a curve of 91 ft. radius and continues under Greenwich street to the terminal station at Christopher street. The completed portions of the two tunnels are shown by the heavy solid line, and the uncompleted portions by the broken line. The terminal plans have not yet been decided upon and the details of the approaches are still under consideration and subject to changes.

The profile of the north tunnel, Fig. 2, shows the depth of the tunnel under the river bottom and the grades at the approaches. The maximum depth of the top of the tunnel below mean low water is 78 ft., at which point it is 31 ft. below the bottom of the river. The minimum distance between the top of the tunnel and the river bottom is 12 ft., about 400 ft. out from the New York pierhead line. The maximum grade is 3.75 per cent., which occurs on the approach to the New York terminal from Morton street to Christopher street. It was deemed advisable to complete the north tunnel without changing its diameter, although an 18-ft. diameter gave a larger clearance than was absolutely necessary. At the same time it was decided to build the south tunnel with a 15-ft., 3-in. diameter, as it was estimated that this would leave sufficient clearance for the passage of electric cars, for which the tunnel is intended. The south tunnel will have practically the same depths and grades, and its top will be level with the top of the north tunnel.

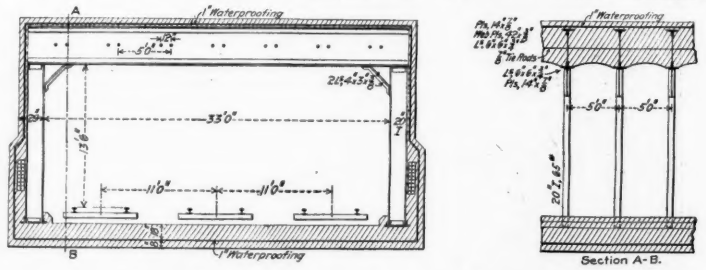


Fig. 7.—Section of Three-Track Tunnel Without Supporting Columns.

Work on the north tunnel was begun by the New York & Jersey Company on Oct. 22, 1902. The old shield, brought over in 1890 from England, is being used, be-

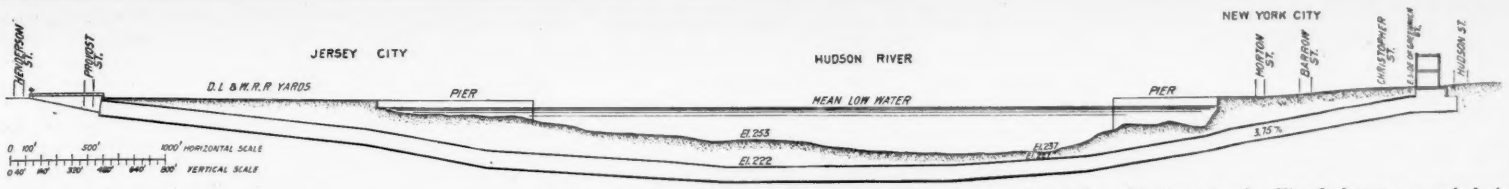


Fig. 2.—Profile of North Tunnel and Approaches.

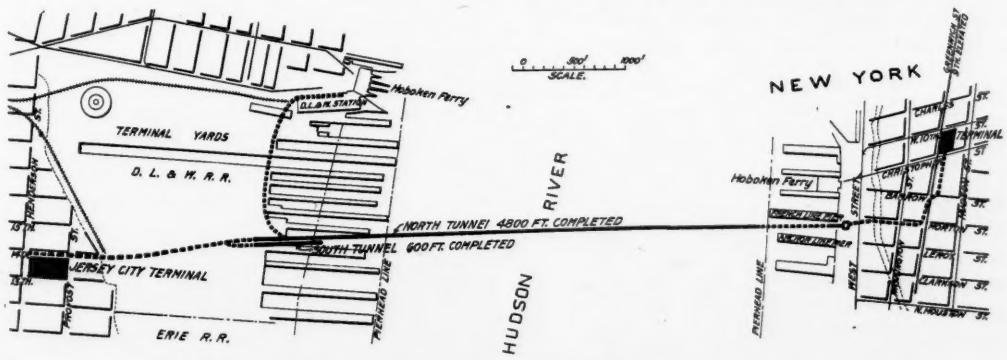


Fig. 1.—General Plan of Tunnels and Approaches.

cause owing to the small amount of silt above the top of the tube, the removal of the old shield and the substitution of a new and more modern one, would have proved to be a very difficult and dangerous undertaking. The shield now in use consists of a cylinder, having a central division formed with openings through which the compartments in the advance end of the cylinder can be entered. The work of excavating is carried forward in each compartment, the material being passed through the door. The edges of the cylinder form cutting edges which enter the silt as the shield is pushed forward by means of hydraulic pressure. The shield completely covers the face and sides of the heading and its rear portion overlaps the finished work, so that there is no portion of exposed silt in the chamber. Compressed air is used in the heading to aid in forcing the shield, and to prevent the entrance of water through the compartment openings when the doors are opened and digging going on.

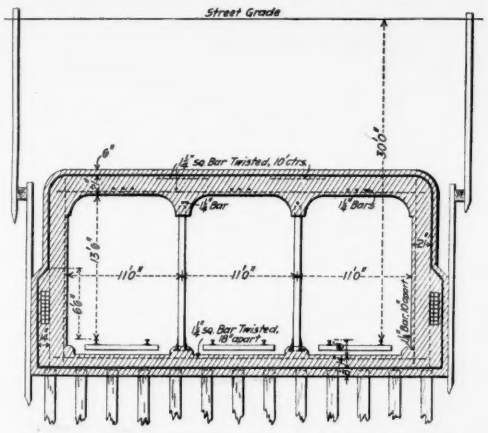


Fig. 8.—Section of Tunnel with Concrete-Steel Construction.

The shield is 19 ft. 5¼ in., outside diameter, and 10½ ft. long. The bulkhead is placed 5 ft. 8 in. back from the forward end. The shell is formed of ⅝ in. steel plates, the bulkhead being the same. The advance chamber of the shield is divided into nine compartments by means of two vertical and two horizontal walls, placed 6 ft. 4 in. apart. In each chamber is a bench which reaches downward to a point just below the bottom of the door, thus making a sort of caisson to exclude the water from the tunnel. The excavated material is thrown through the doors to the bottom of the rear half of the shield,

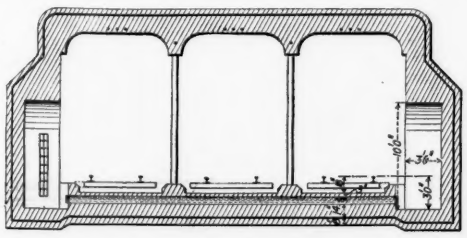


Fig. 9.—Ducts and Manholes at End of Concrete-Steel Construction.

and from there removed in cars. The rear part of shield is without divisions. In this part the work of erecting the cast iron segmental plates forming the tunnel is carried on. These plates are handled by a double-acting radial erecting bar operated by hydraulic cylinders.

Soon after beginning work in 1902, a bed of rock was encountered. As the old shield was designed for cutting through silt only, it was found necessary to make several alterations so as to render it suitable for drilling and blasting. For this purpose an apron was built out 6 ft. in front of the cutting edge of the shield. It was constructed of 12-in. I-beams and ¾-in. steel plates, and riveted solid with the shield itself. Under it the sides of the excavation were heavily timbered. The apron thus permitted the advance of the shield, and by supporting the earth above, allowed the drilling and blasting to be carried on a few feet in front of the shield. As the rock encountered lay in ridges, in no case rising to the top of the tunnel, this apron enabled the company to complete 800 ft. of the tunnel during the past year, a good part of which was through solid rock. The north tunnel is now completed for a distance of 4,800 ft. from the Jersey shore, and only about 75 ft. of the remaining 800 ft. is rock excavation. By building the south tunnel with a diameter of 15 ft. 3 in. diameter, and thus elevating it 2 ft. 9 in. above the bottom of the north tunnel, the amount of rock to be removed will be materially lessened, as many of the ridges encountered by the north tunnel will be entirely below the bottom of the south tunnel.

Work on the south tunnel was begun on the Jersey side a few weeks ago, and a shaft will be sunk at the New York end so that work may be carried on from both sides of the river at the same time. This, together with the improvements made in the new shields which are to be used on the south tunnel, will enable the company to carry on the work much more rapidly than has been the case in the construction of the north tunnel. The shields for the south tunnel are of special construction, designed by Messrs. Jacobs & Davies, and built by the Watson-Stillman Co. They are stiffened vertically and horizontally by steel frames and transverse diaphragms. A movable cantilever working platform is built out from the front end, which may be forced out beyond the cutting edge when necessary. The hydraulic jacks and valves for moving the shield and operating the lining segment erector are placed back of the diaphragm. The details of the south tunnel lining are shown in Fig. 3. It will be composed of cast iron segmental rings, 24 in. wide, made up of nine segments and a key, and weighing 11,340 lbs. The lining for the north tunnel is composed of similar rings 20¼ in. wide, each having 11 segments and a key. The segments have webs 1½ in. thick and 8 in. deep. One ring weighs 12,765 lbs., or 7,565 lbs. per linear foot.

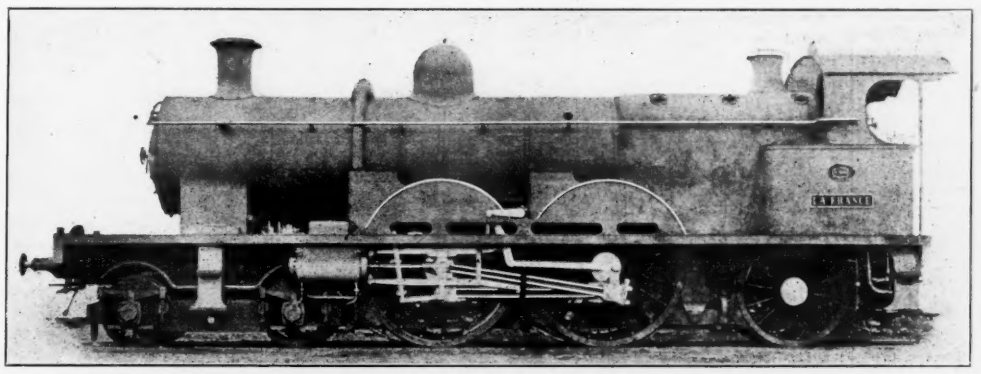
The construction of the New York approaches is shown in Figs. 4 to 9. After the tracks emerge from the iron-lined tunnels under the river, they are carried under Morton street in a double arch concrete tunnel shown in Fig. 4. The arches will be 17 ft. 6 in., center to center, and will have a circular roof with a radius of 7 ft. 6 in. The side walls will be 4 ft. thick, the arch roof 2 ft., the floor 2 ft., and the division wall 2 ft. 6 in. thick, inside the water proofing. A thin layer of concrete will be laid over the water proof covering to protect it from the surrounding earth. Fig. 5 shows the construction of that part of this section where provision must be made for supporting the elevated railroad structure above the street. Latticed columns will be sunk in the concrete which will be carried up above the roof of the tunnel as buttresses 3 ft. 6 in. wide, and the present columns of the elevated structure will rest on them on bed plates set just below the street level. Fig. 6 shows a man-hole into the tunnel extending down from the street.

Where the two-track tunnel opens out into the three-track line, extending into the terminal station, the construction shown in Fig. 7 will be used. The cross-over switches at this point prevent the use of supporting columns for the roof and instead, a heavy plate girder construction is employed. These girders will be spaced 5 ft. apart and will be 44 in. deep. The concrete roof will be arched between the girders as shown on the section A-B. These girders will be supported on 20-in. I-beams set against the walls. The tracks will be spaced 11 ft., center to center, and the inside width between the I-beam columns will be 33 ft. The height from the top of rails to the under side of the roof girders will be 13 ft. 6 in.

Adjoining the single span section is one of concrete steel construction with supporting columns for the roof between the tracks which runs into the terminal. Twisted steel bars, 1¼ in. square, are laid in the concrete in the floor as well as in the sides and roof. The concrete will be 21 in. thick on the sides and roof, inside the waterproofing. All of this work will be built in open cuts, and where the ground is soft the tunnels will be supported on piling as shown in the sections. The rails will be laid on stone ballast. We are indebted to Mr. W. G. McAdoo for the drawings of the tunnels and approaches.

De Glehn Compound for the Great Western of England.

The Great Western Railway will soon put into service a De Glehn compound, 4-4-2, express locomotive which will be given a thorough trial in hauling heavy fast trains. The engine was built by the Société Alsacienne de Constructions Mecaniques of Belfort, France, which has built a large number of this same type of locomotives for the Chemin de Fer du Nord, on which road they are exclusively used on fast runs, notably the Mediterranean express, which is timed to make the trip between Calais and Paris, 184¾ miles, in 3 hours and 15 minutes, including one stop to change engines. The Great Western compound was erected in the builder's shops and then dismantled and shipped to the railroad shops at Swindon, where it is now being re-erected and put in condition for service. The illustration is made from a photograph taken before the engine was taken apart for shipment. This is the first compound engine on the De Glehn system to be used in England and the results of the trials with it will be watched with much interest both there and in this country, especially since



De Glehn Compound for the Great Western of England.

the Pennsylvania has also ordered a locomotive of the same type to be tested at St. Louis next year, and later to be tried in service.

The Great Western engine is very similar to the compounds on the Chemin de Fer du Nord with which our readers are familiar. The two high-pressure cylinders, 13⅜ in. in diameter, are placed outside the frames and coupled to the rear pair of drivers. The two low-pressure cylinders, $22^{1}/_{16}$ in. in diameter, are placed inside the frames under the fire-box and drive the first pair of wheels through a cranked axle. High-pressure steam can be admitted into the low-pressure cylinders through a reducing valve operated by the engineman from the cab. A three-way valve in the cab operates auxiliary valves on the high-pressure cylinders to divert the exhaust steam directly into the blast pipe. When running compound, the high-pressure exhaust passes through these auxiliary valves into the low-pressure cylinders. The valve gear is of the Walschært type and the distribution of steam to the high-pressure and low-pressure cylinders can be independently controlled by manipulating the reversing gear and practically any rates of expansion may be used which are found desirable for given running conditions.

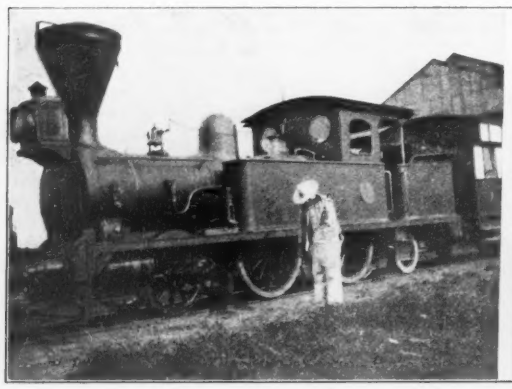
The boiler, which has "Servé" tubes, is of the Belpaire type with the top of the fire-box flush with the top of the barrel. With a working steam pressure of 227 lbs. per sq. in. the engine has a calculated tractive effort of 28,814 lbs. The tender will be the Great Western standard six-wheel pattern with a water capacity of 3,000 gallons and equipped with water scoop. The total

weight of engine and tender is 227,920 lbs., the engine itself weighing 145,600 lbs., with 76,160 lbs. on drivers.

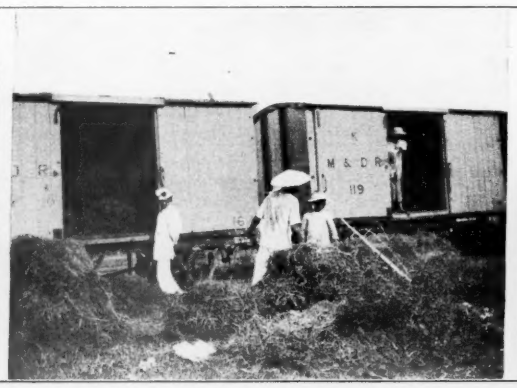
We are indebted to *Transport*, London, for the illustration and the details of the description.

Railroads in the Philippines.

When the Taft Commission reported on the condition of the Philippine Islands it called attention to the fact that the Manila & Dagupan Railroad, running between the points named, on the island of Luzon, was the only railroad in operation. This road, which was built by English capital and opened in 1892, is 122 miles long, 3 ft. 6 in. gage, traversing a low-lying, fertile region densely populated. According to the Commission, it was perhaps improperly located in the beginning, and, crossing as it does a number of streams near their mouths, it was expensive to build and this expense was increased by unnecessary requirements of the Spanish Government. As a result it appears to have cost the company about $60,000, gold, per mile, and it is an expensive line to maintain by reason of the fact that several of the streams in seasons of flood overflow their banks and inflict much damage upon the roadbed. Because of these drawbacks it has not proved a profitable investment, but would have paid well on a reasonable and proper outlay. But, while the railroad has not earned a fair interest on the extravagant sum it cost, it has been wonderfully beneficial in increasing the population and wealth of the provinces through which it runs and affords a striking illustration of the benefits which might be expected to accrue if railroads were built in other sections of these islands, now wholly or partially inaccessible.



Manila & Dagupan Locomotive.

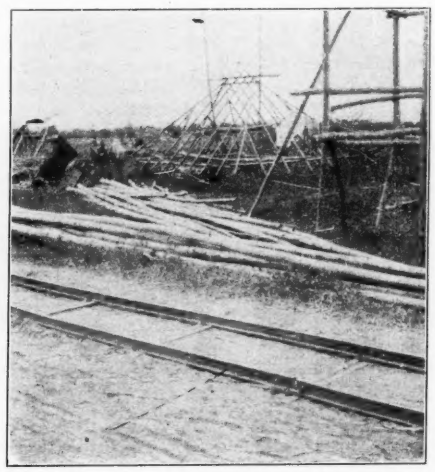


Box Cars and Native Laborers.

Starting into the Jungle.

Under the Spanish regime a number of extensions were proposed, although nothing definite was done about them. One of these was to run along the western coast, from Dagupan to the northern end of the island of Luzon, 200 miles. Another was to branch off from the main line at Calumpit, start out along the Rio Grande de Pampauga Valley and eventually reach Aparri at the northern end of Luzon, a distance of somewhat over 300 miles. An important line in view of the territory it was projected to reach, was also talked of to run from Manila southwest and then southeast through the Provinces of Cavite, Laguna, Tayabas, Camarines and Alay to Sorsogon, at the southern end of the island of Luzon, about 200 miles away. This road would not only run through a rich and densely populated country, but it would be easy to build. Another proposed line was to run from Manila eastward and southeast along the shores of Laguna de Bay across the island, reaching a port on Lamon Bay said to be the best in the Philippines. This line, if built, would shorten the distance from Manila to the United States 700 miles.

Tram Between Ilo Ilo and Jaro (Panay).



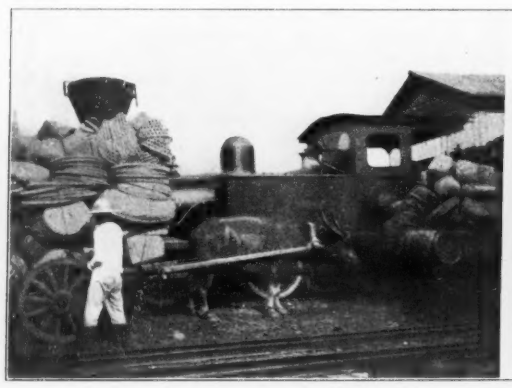
Sectional Construction of Track.

According to most recent advices, the United States engineers at work have investigated and reported not only on the little steam railroad of the jungle, now in operation between Manila and Dagupan, but have recommended definite steps to be taken toward general improvement of the railroad system and the installation of new lines in the commercial districts. In addition to surveys which have been made by Captain Charles W. Meade, U. S. A., for a line to connect Baguio, which has been made the summer capital, with Dagupan, 55 miles away, thus affording connection with Manila, the proposed system calls for franchises extending some 600 miles on the island of Luzon, all running out of Manila. Three lines are proposed—one from Manila to Aparri, 336 miles, at a cost of $6,675,602; another from the present terminus of the Manila-Dagupan Railroad at Dagupan, north to Laoga, 168 miles, at a cost of $3,367,000, and a third south from Manila to Batangas, 70 miles, at a cost of approximately $1,100,000. In the estimated costs given in a recent report, it is stated that the native timber is not to be had in large quantities, and that the timber for these railroads will probably have to be shipped from the American coast. The report also states that the native wood is too soft for ties and, therefore, its use in this respect is out of the question. Little difficulty is anticipated in securing capital to build the roads designed to tap the cocoanut and wooded sections of the country. The cocoanut industry is a vast one here, as the cocoanuts are secured for export in the form of copra and large quantities are shipped to the seaports annually. The tobacco regions also offer an undeveloped field for railroad operations. Most of the tobacco plantations are paying and the output has to be handled by slow means of transportation. It is proposed also to open up the coffee and general cultivating regions, mahogany woods, the mines in the hills, the dye-wood swamps, the rubber sections, etc. Both steam and electricity have been considered in the scheme of development. Water power is abundant in many parts of the islands and electric power has been given special consideration for the line to Baguio, previously referred to, which is to run through mountainous country and has been surveyed with 3 per cent. grades; to be built at an estimated cost of $2,500,000 gold, for the 55 miles.

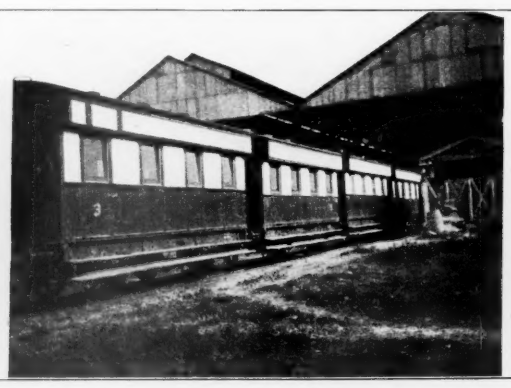
Meanwhile, the present little road runs merrily along. It has been called the war railroad because of the many war incidents so centered about it during the late insurrection. The road has been vastly improved during the past year or two under American guidance, although most of the employees are natives with American overseers here and there. The main depot at Manila is quite a good-sized building erected something after the plan of the ordinary union or central station, except for the absence of many facilities for keeping crowds in order. When the writer was there, a mob of natives could periodically be seen waiting for the train, all standing near the gates, and in fully ten visits to this station within a few weeks he concluded that the road never lacked custom. As soon as the gates open, the crowd rushes in to get seats and in a moment every part of every car is taken and many passengers have to stand. In fact, there is considerably more patronage than the road can accommodate. First, second and third class passengers are carried; first class being limited chiefly to army officers and merchants, second class Filipinos, and third class, as a rule, Chinese.

In the yards, native track crews work under Spanish bosses pretty much the way track gangs work anywhere else. Since the change of administration, considerable track work has been done, and most of the defective rails and bad ties have been replaced with new ones. The American authorities require that the road be maintained in order and have inspectors to see that the laws are obeyed. Not much weight can be hauled by the little locomotives, imported from England at the time the road was built, and no attempt is made at fast time. It takes some eight hours to run from Manila to Dagupan, including the stops at the various stations. Native enginemen and firemen are employed.

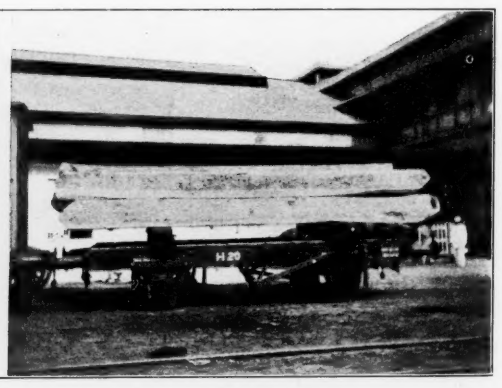
There are 34 engines on the line and they are kept in fair order and seem to be in good running condition.



Miscellaneous Freight.



First Class Coaches.



Mahogany Logs.

The cars are small with limited seating and storage capacity, and at the time of recent reports the company owned 120 coaches and 556 freights. The first class cars have seats and some windows, but everyone is not fortunate enough to get a window, and for third class passengers box cars are often used. There is a footboard outside the car for the conductor, since space inside is limited. The conductors are, as a rule, Filipinos, who wear a half-way uniform with a few gilt buttons and are very slow in taking tickets or making change. The brakemen are natives.

A few of the trains have power brakes, and American

air-brakes are used in some instances. The cars of the first class are fairly well lighted, the others are lighted poorly, if at all. The road gets all kinds of freight to haul and does a pretty good freight business, with quite a traffic in manufactured products, such as baskets, hats, fabrics, etc., which are sent into the Manila markets from the outlying towns. One of the chief sources of traffic is hard-wood timber. Freight rates are good and it is very profitable for the company to haul even the heavy and bulky freight.

The Spaniards do not seem to have given any particular thought to extensions in any of the islands except Luzon, yet the Taft Commission believes that there are excellent openings elsewhere, particularly on Mindanao. With this article are photographs of a type of railroad fairly common in the islands; the tram designed to haul sugar. The road shown runs between Ilo Ilo and Jaro, on the island of Panay, without very much regard to such minor matters as alinement. As may be seen in one of the pictures, it is portable and the sections can be moved readily. There are very few highways on the islands, however, which are adapted to any use of this sort, most of them being little more than rough trails, and the Manila & Dagupan Railroad really stands as the only representative of rapid transit in a country so great that a perpendicular as long as the distance from Lands End to Gibraltar could be drawn between the northern and the southern extremities of the islands.

Canadian Pacific Locomotives From Germany.

Last spring it was announced that the Canadian Pacific had placed with the Saxon Engine Works, Chemnitz, Germany, an order for 20 Pittsburg-system two-cylinder compound ten-wheel (4-6-0) freight locomotives. They were to be built to Canadian Pacific specifications and drawings, the contract having been let to the German builders because an early delivery could not be obtained from American or Canadian works. The engines were designed by Mr. E. A. Williams, Superintendent of Rolling Stock.

A description of a ten-wheel two-cylinder passenger locomotive for the Canadian Pacific was given in the *Railroad Gazette*, Aug. 15, 1902, and the following table, which gives the general dimensions of that engine and also of the new freight locomotive, shows the similarity between the two machines.

	Ten-wheel passenger.	Ten-wheel freight.
Total weight, lbs	165,475	169,000
Weight on drivers, lbs	126,125	128,000
Heating surface, sq. ft	2415.5	2421
Cylinders, in.	22 and 33 x 26	22 and 33 x 26
Diameter of drivers, in	69	63
Working pressure, lbs	210	210

It will be seen from this table that the only marked difference in general design is in the smaller size of drivers of the freight engines. The estimated maximum tractive effort of the new locomotive is 24,900 lbs. The maximum tractive effort of the passenger locomotive is $\frac{63}{69} \times 24{,}900 = 22{,}700$ lbs.—the difference in tractive effort being due solely to the difference in the diameter of the drivers. All the drivers of the freight locomotive are flanged whereas the middle pair of drivers of the passenger locomotive has plain tires.

The low-pressure cylinder has the Morse-Allen balanced slide valve and the high-pressure cylinder has a piston valve. The valve motion bar is an I section and the valve rod receives its motion through a block-and-slot arrangement on the rocker arm, which arrangement avoids the springing motion of the valve rod such as occurs when no rear bearing is used for supporting the rod. The diaphragm in the front-end of the locomotive terminates in a vertical plate in front of the blast pipe extending down to within 6 in. or 8 in. of the shell. Double petticoat pipes and a circular netting are used. The fire-box crown-sheet is sling stayed and the holes for the sling stay-bolts in the crown-sheet are reamed out so that the bolt will go up to within about ⅛ in. from the head, after which it is driven up to the plate with a hammer. The six center rows of stays are fitted with steel nuts ⅝ in. thick and copper washers $^1/_{32}$ in. thick under the crown-sheet.

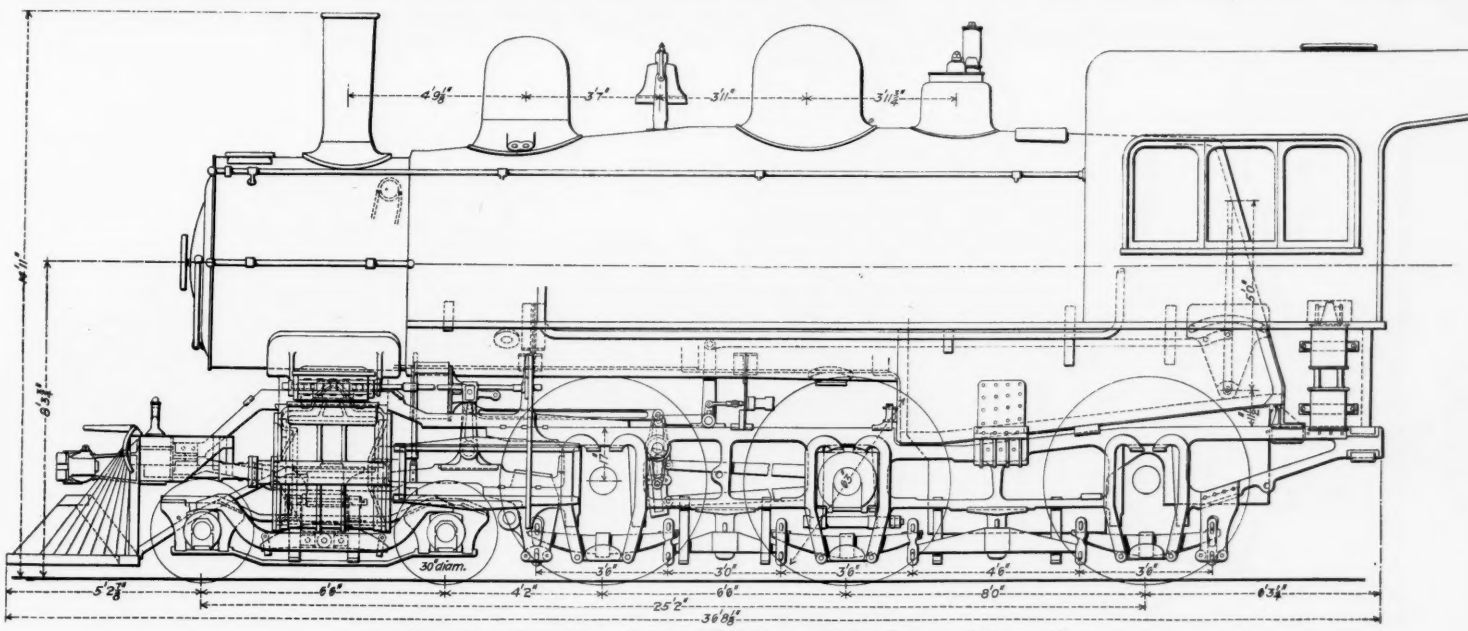
The boiler is the extended wagon-top type and is 75⅛ in. outside diameter at the dome course. The boiler contains 328—2-in. tubes 13 ft. 2⅛ in. long. The fire-box is steel, 9 ft. 6 in. long and 3 ft. 5⅞ in. wide, and the grate area is 33.2 sq. ft. The fire-box contains 159 sq. ft. of heating surface. The tender has a capacity of 5,000 Imperial gallons of water and 10 tons of coal.

Some of the typical ratios follow:

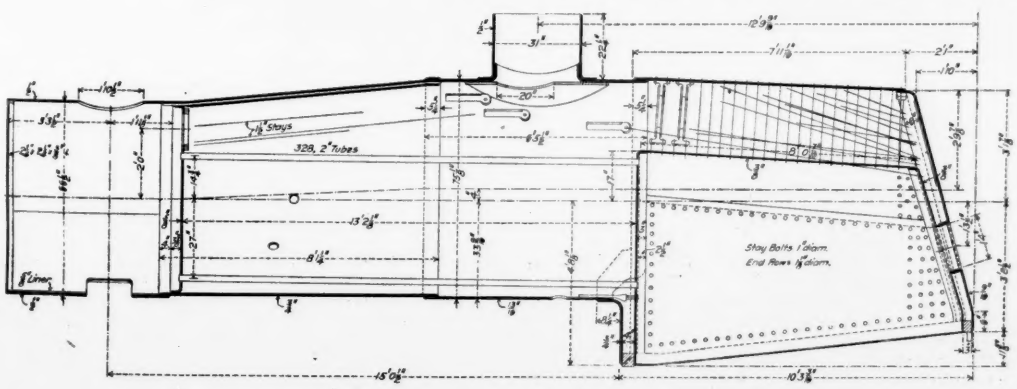
Weight on drivers divided by maximum tractive effort	5.14
Weight on drivers divided by heating surface	52.9
Heating surface divided by grate area	72.9
Heating surface divided by h.p. cylinder volume	423.3
Grate area divided by h.p. cylinder volume	5.9
Fire-box heating surface divided by total htg. surface.	6.57
Steaming capacity*	.20

*See *Railroad Gazette*, June 19, 1903, p. 441, for formula giving steaming capacity of compound locomotives.

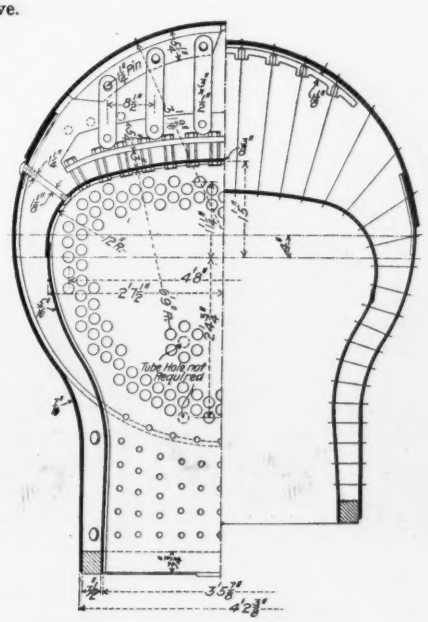
The special equipment includes Michigan lubricators, U. S. metallic packing, Damascus nickel-bronze bearing metal, Washburn pilot couplers, Tower tender couplers, Leach sanders, "Little Giant" bell ringers, Star whistles and steam gages, Edward's electric headlights, Simplex truck bolsters and brake-beams, Westinghouse automatic brakes on engine and tender and Gold steam heating system.



Elevation of Canadian Pacific 4-6-0 Two-Cylinder Compound Locomotive.



Boiler of Canadian Pacific Two-Cylinder Compound.



Section Through Fire-Box.

A German journal devoted to the public health has discovered that the substitution of electricity for horses on street railroads has purified the air, not only negatively, by reducing the amount of dust, but positively by the electricity which escapes into the air at points, etc. These electrical discharges convert oxygen into ozone, which is a most powerful disinfectant and is death on microbes. Now we know why people in cities have been so beastly healthy of late years.

The Detroit Group of Electric Railroads.

As a continuation of the descriptions of centers of sharp competition between steam and electric railroads, which have previously been printed in the *Railroad Gazette*, the present article takes up the territory in the vicinity of Detroit. The lines centering at Detroit reach approximately 65 cities and towns, and extend on the west as far as Jackson, 76 miles; on the north to Flint, 68 miles; on the northeast to Port Huron, 74 miles, and on the south to Trenton, Mich., and Amherstburg, Ont., 18 miles, aggregating nearly 400 miles, exclusive of city lines not forming portions of the through routes. When a short gap between Trenton and Monroe is filled, there will be an unbroken line from Detroit to Toledo, and it would be possible to run a through car from Painesville, 30 miles east of Cleveland, to Port Huron, Flint, or Jackson.

The two maps printed with the present article show the competitive territory. They are on the same scale and the steam roads are only filled in between points reached by the interurban lines. Exclusive of the numerous companies which form the Detroit United system there are only two operating units among the electric lines; the Detroit, Ypsilanti, Ann Arbor & Jackson road running between the points named, with a short and unimportant branch, and the ramifications of the Detroit United and Rapid Railway routes to Flint, Port Huron, Pontiac, etc. The two companies present no important differences in respect to cars run, schedules, etc., but maintain a somewhat different attitude towards their steam competitors. There has always been friction between the Michigan Central and the Detroit, Ypsilanti, Ann Arbor & Jackson, and this is shown in several ways, chief among which may be noted the competition in express and package traffic. Mr. J. D. Hawks, President of the electric line, does not believe that electric railroads have any interest in low class freight and he makes no effort to secure this kind of traffic, as is done, for ex-

ample, by the Rochester & Sodus Bay, along the southern shore of Lake Ontario, which received comment in the *Railroad Gazette* last week, and in previous issues. But in package freight the Detroit-Jackson road has been aggressive. Its rate schedule on this kind of traffic was formerly the same as the schedule existing on the Michigan Central, but the electric road maintained a free delivery at certain points as an extra inducement.

Shortly after the inauguration of the package service the Michigan Central cut its rates on like commodities in two between competitive points, but did not attempt to institute free delivery. The electric road has not met this cut, but seems to be able to secure its full share of business notwithstanding; partly on account of the free collection and delivery, and partly, no doubt, because it is backed up by public sentiment and a kind of popularity which is generally found under similar circumstances. A parallel case is the experience of the Delaware, Lackawanna & Western in trying to compete with the Syracuse, Lakeside & Baldwinsville electric road, where the electric line secures almost all the business at higher rates because a cut previously made by the steam road to dispose of threatened competition was immediately changed to full former rates after the competition ceased. The Detroit United lines do not seem to be making a serious effort at present to compete for light freight traffic. There are some seven or eight express cars running continually on the system, but they seem designed rather to serve as a convenience to the passenger patrons of the company than to build up or compete for much new business at the expense of the steam roads. The freight carried over the Detroit United lines from Detroit must first be brought to their central freight warehouse at the expense of the shipper, and the business done is not aggressive.

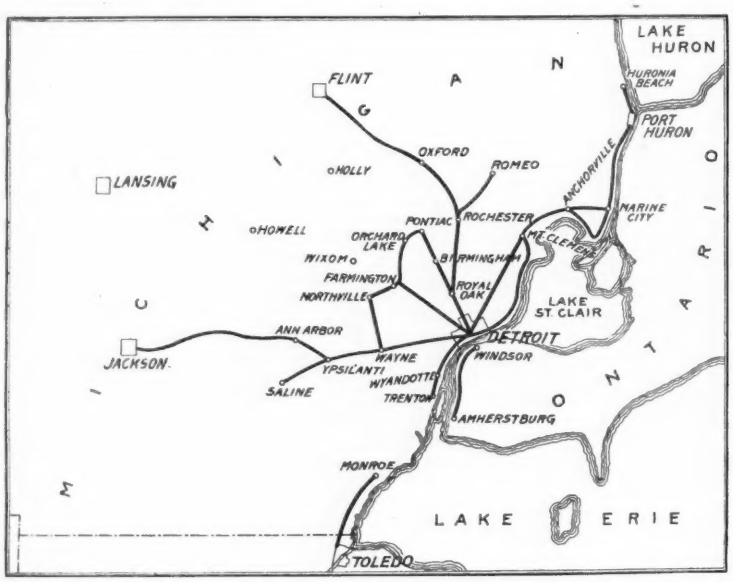
Officers of the Grand Trunk, which is perhaps more sharply affected by the Detroit United competition than

reported separately, but are included in the item, income from other sources, and this income together with the receipts from advertising in the cars, amounted to less than $29,000 in 1902, so that it may be seen that the freight business on these lines is not yet of any particular importance. The Rapid Railway system also earned $172,917 net and the Sandwich, Windsor & Amherstburg $35,351, so that the joint earnings of these three properties under the same control amounted in 1902 to about $7,707 a mile gross and $3,389 a mile net. It is unfortunate that the accounts are not kept in such a way that the strictly interurban business can be separated from the city traffic, for more than 100 miles of the total mileage operated is city tracks which are not directly concerned in the through routes, according to the distinction drawn previously.

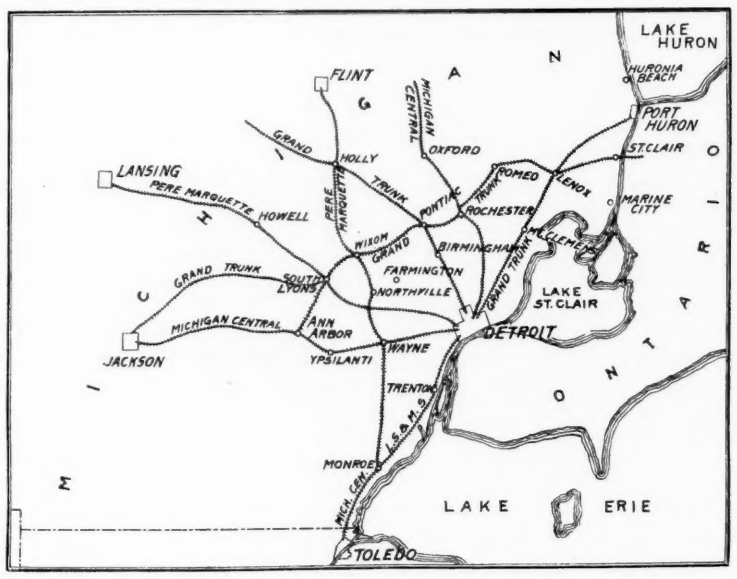
The growth of the street railroads in Detroit has some rather amusing features. When the rapid extension of lines was begun, some six or eight years ago, there was the usual rush for franchises, and in certain parts of town there are franchises in existence in almost every street. A large number of these franchise-holding lines, which are pretty much without value so far as any efficient transportation scheme is concerned, have been built and are operated with cars run every once in a while, in order to comply with the law. There is a very apparent waste of plant occasioned in this way, and to get rid of the dead wood for purposes of economical operation will be a problem which must surely confront the management at some time or another. The residence portion of the city may be said to be unusually far removed from the business center in proportion to population, and each one of the principal thoroughfares radiating from the City Hall district like the ribs of a fan, is the route of an interurban line. The mere statement that a regular service is maintained to three points over 65 miles away does not mean very much without the co-

about a cent a mile in the cheapest form, and the running time, in connection with increased convenience, evidently satisfies the traveling public. Figures to show the shifting of the short haul passenger traffic to the electric lines have previously been printed in the *Railroad Gazette*, in connection with other competitive localities, and the results at Detroit are the same as elsewhere; the actual transfer of previously existing traffic constitutes only a small portion of the total business gained and created by the interurban lines. It may be pointed out that in 1897 it was estimated in the Michigan Central office that 200 passengers a day were carried on that line, short haul, between Detroit, Dearborn and Ann Arbor. At that time there was no other means of communication between these points, but in the summer of 1898 the first 39 miles of what is now the Detroit, Ypsilanti, Ann Arbor & Jackson was put in operation, extending through this same territory as far as Ann Arbor. The business done by this road in the first season of existence was not far from 4,000 passengers a day, or *twenty times* the previous Michigan Central traffic. The Jackson extension was completed in September, 1901, and in 1902, on the entire line, 1,944,061 passengers were carried; an average of 5,326 a day, winter and summer. These figures show more on this road than on the Detroit United properties, representing as they do entirely interurban business, except for the unimportant local line in Ann Arbor. The Hawks road has trackage rights into Detroit over the United lines, and does not do much local business in that city.

The ratio of 4,000 passengers a day to 200 passengers a day shows what is meant when the statement is made that electric interurban lines start people traveling. Traveling is perhaps far more a matter of habit than has generally been recognized, for it is inconceivable that necessity or even partial necessity should have occasioned 20 trips in 1898 where it occasioned one in 1897. There



The Detroit Group of Electric Railroads.



Steam Railroads in Competitive Territory.

any other road, are inclined to think that the electric business is, from their point of view, perfectly legitimate, and the steam road believes it could undercut the electric if the latter really tried to compete on freight and package traffic. There is some doubt about this in the mind of the writer, but the situation as it stands is not of especial concern to railroad men.

With reference to the cut in Michigan Central package rates, and to that company's failure to provide free collection and delivery, it must be remembered that it would be difficult for a steam railroad to institute such a service at specific points on its line without getting into trouble with the Interstate Commerce Commisssion on grounds of discrimination. Companies operating under electric laws are far more favorably situated in this respect, as the existing laws are chiefly the outgrowth of horse car legislation and are in a thorough muddle. Railroad officers in Detroit believe that the electric railroads are likely before long to run up against serious difficulties with the Interstate Commerce Commission in connection with the development of their through routes, and that they too will soon be confronted by the bugbear discrimination, but at present they can operate, in Michigan, at least, with the greatest freedom. According to the present interpretation of the State laws there is no objection raised to their handling package freight and express business, but they are not allowed to carry low grade freight, such as coal, etc. The garden truck business, which is becoming very important indeed to the roads in the Rochester and Albany groups, previously described, where the electric cars make special night trips to bring farmers' products into the city, and have in considerable measure supplanted trucking, has not yet assumed large proportions in Detroit. The fruit business, however, is fairly important.

The annual report of the Detroit United for the year ending Dec. 31, 1902, shows a total mileage of 514, including the Rapid Railway system and the Sandwich, Windsor & Amherstburg, across the river in Ontario, and the company earned $3,473,140 gross and $1,534,222 net. Earnings from freight and express business are not

ordinate statement that genuine through business is found. It would scarcely have been predicted five years ago or even three years ago that passengers would be carried to any appreciable extent between Detroit and Jackson, Flint, or Port Huron by an electric line, because of the difference in running time between it and the steam trains, occasioned by roadway, motive power, and frequent stops, but a system of specials are run which make only a limited number of stops between the termini, and in view of the fact that the lines, almost without exception, run alongside the highway the time that is made is quite surprising.

Two specials daily in each direction are despatched from Detroit to Port Huron, leaving Detroit at half-past eight in the morning and half-past one in the afternoon. These cars make only six stops between the cities and run the 74 miles in 2 hrs. and 37 mins., which is just about the same as the running time of the accommodation trains between New York and New Haven on the New York, New Haven & Hartford Railroad, over an identical distance. The average running time of these Detroit and Port Huron specials is thus seen to be nearly 30 miles an hour. A similar service of specials is run to Flint, 68 miles, in 2 hrs. and 30 mins., which is equal to a little over 27 miles an hour average running time. On the Hawks line to Ann Arbor and Jackson, specials are not at present run, and the cars make more stops, but the 39 miles to Ann Arbor is run in two hours and a quarter, which is at an average rate of nearly 18 miles an hour, including time lost in getting out of Detroit. Between Jackson and Ann Arbor, 37 miles, the running time is an hour and a half, which is at the rate of over 24 miles an hour, including stops. On certain portions of the line the cars run at the rate of 40 and 45 miles an hour between stops without excessive side motion.

Between Detroit and short haul points not more than, say, 40 miles distant, such as Ann Arbor, it is no exaggeration to say that the electric roads control the passenger traffic, and handle practically all of it. The steam roads do not attempt to meet their rates, which run

can be no question, also, that it is a short step from the long ride on the interurban car to patronage of the steam road, so that the railroads doubtless have much to thank their electric competitors for in their inculcation of the habit of travel.

The freight business of the Detroit, Ypsilanti, Ann Arbor & Jackson is far more important than that of the Detroit United lines, which, as previously stated, are not particularly aggressive in this respect. As against combined freight and car advertising earnings of $29,000 on some 325 miles of interurban and 175 miles of city lines, on the Detroit United and its allied properties, the Detroit, Ypsilanti, Ann Arbor & Jackson does a freight business of about $50,000 a year, on 100 miles of line. A great variety of high class freight is carried, and the fact that it can be brought to the consignee at all sorts of odd times of day and at short notice is doubtless the occasion of much traffic, of a kind which would not be profitable to a steam railroad, but becomes worth while to a company that can handle it in small units. Freight traffic on the electric road declined at first, when the Michigan Central cut the rate in half, but increased again almost immediately, and seems now to be gaining rapidly and continuously.

A feature of the freight tariff which is doubtless of great convenience to patrons is the provision made for carrying packages not exceeding 10 lbs. in weight between any two points on the line for 15 cents. C. O. D. packages are accepted for transportation with a small charge for collection, unless the shipment exceeds $100 in value, in which case special instructions are required. Milk is carried for 10 cents a can, and empty cans are returned free.

If a single feature were to be singled out as the most interesting, in the Detroit situation, it would be the long hauls and the accompanying high speeds. In the other localities reviewed—Cleveland, Rochester, Utica, Albany and the Massachusetts group, the success of extensions beyond about 40 miles from the terminus, so far as through traffic was concerned, seemed doubtful. Although the Detroit roads do much their best business on

the "nigh end" of the line, and it has been in some specific cases questionable whether the more remote extensions were going to pay for themselves, yet what might be called the profitable radius is certainly in excess of 40 miles, and is probably in excess of 50.

Freight Business on Electric Railroads.

BY J. D. HAWKS.

Mr. J. D. Hawks, President of the Detroit & Mackinac, and also of the Detroit, Ypsilanti, Ann Arbor & Jackson (Electric), discusses this subject in the *Gateway*. In his dual position as president of a steam railroad and of an electric railroad which competes sharply with another steam road, not only for passenger, but also for package and freight traffic, Mr. Hawks is peculiarly well qualified to write on the subject, and his idea that the freight business of electric roads is strictly limited by the conditions of operation is one which has not heretofore received very careful attention. An account of the working and competitive features of the Detroit, Ypsilanti, Ann Arbor & Jackson, in connection with the other electric lines in the Detroit group, is printed elsewhere in this issue. Mr. Hawks's article follows:

For the purpose of this discussion it is advisable to dismiss from consideration electrified steam roads as having no bearing and also to eliminate electric roads running through a country not already supplied with steam road facilities. Such roads will be built, but the fact that steam road facilities are not already supplied is an indication that the country is sparsely settled, and that it is not attractive to the steam roads, and, moreover, that it has too few inhabitants to furnish enough passengers to make a first class electric railroad profitable.

This narrows the problem down to the consideration of the class which includes the majority of electric railroads which have been built, practically in competition to steam roads between populous cities and villages, and through thickly-settled country. It is true that many of these roads carry what is called freight, but this is a misnomer, as they carry what should more properly be classified as express matter or package freight. There is not enough of this high-class freight to congest the electric road, which enjoys the same advantages in handling it as it has in passenger traffic, namely, quick delivery. The usual practice is to adopt the same classification as the steam railroad, down to and including fifth class, with some special commodity rates, and to charge about the same rate as the steam road. I have in mind an instance where a steam road became disgusted and cut the rate in two because the electric road took the package business. This was done expecting that the electric would cut its rate and continue to get the business, but at a reduction of one-half of its gross earnings, a very neighborly performance. There was a slight loss of business on the electric road for perhaps a week, and after that, although no reduction was made, there was a steady increase because the shippers understood that the steam road was endeavoring to drive the electric road out of the freight business, and, this accomplished, it would then put up its rates to the old figure, with all of the old disadvantages.

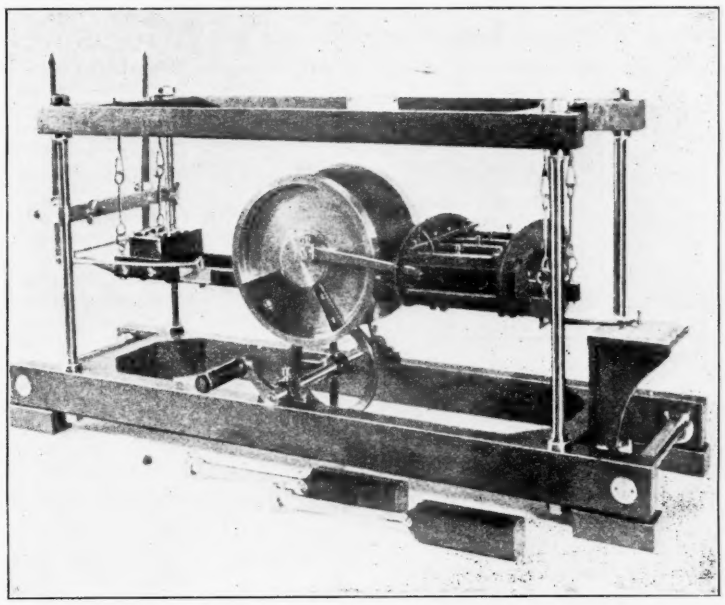
The commanding advantage which suburban electric roads have constitutes the fact that their main business is done on city roads, with no expense to them for terminals. The general practice is to turn the suburban cars over to the city company within the corporate limits, the suburban company getting compensation by taking all the city fares in some cases and a percentage of the city fares in others. A new condition confronts them as soon as they depart from their original purpose, for the moment electric roads undertake to haul cheap freight they will have to provide terminals. This would be practically an impossibility in the larger cities. The experience of hundreds of smaller roads has been that it is better to be absorbed by the larger road than to undertake the enormous expense of providing terminals. If there were only a few freight cars a day to move there is still the initial expense of providing a freight locomotive to move them and a power house to furnish current, that would be out of all proportion to the revenue, and, on the other hand, if many cars are to be moved the electric road must become a competitor and take freight away from the steam road.

The situation in the passenger department is entirely different. Electric roads carry an immense number of passengers, only a small proportion of which are taken from the steam road, as the great bulk of this travel originates by reason of the frequency of trains and cheap service on the electric road. While passenger travel can be increased immensely, freight movement practically cannot be increased at all. It would be impossible to go into the market to-day and get money to build steam roads paralleling existing lines; then why should it be any easier to get money to build electric lines paralleling steam roads if it is known that the electric roads are expected to get the freight away from the steam roads?

There is also a grave question as to whether electricity is a cheaper motive power for hauling freight than a steam locomotive, and it certainly has not been proved so far. It is no advantage for an electric road to have level grades, or, rather no disadvantage to build electric roads over the surface of a country which is undulating. Electric machinery lasts much longer when it is given a rest by coasting down grade, and a much steeper up-grade could be surmounted than on a steam road, because of the probability that there will only be one car out of many on the up-grade at once and the demand on the power house, consequently, is only slightly increased by reason of the steep grade, whereas on a steam road every locomotive has to be rated according to the ruling grade.

Many electric railroad men cannot bear to see steam roads doing any business, either in passenger or freight. One of these was superintendent of one of the electric roads in Michigan, and he insisted upon cutting passenger rates from $1.20 for a certain round-trip to 50 cents, because the steam road made the 50-cent rate. He was quieted by being told that a 50-cent rate would not be made until he could show that all the passengers the steam road carried, plus his own passengers, at a 50-cent rate between the two points under discussion, would bring in more gross revenue than his own passengers alone at the $1.20 rate, and this he was not able to do. Another case was where the electric road had a two-mile 'bus transfer, to reach the center of the city by reason of delay in the building of a drawbridge, and notwithstanding this 'bus transfer, and a one-way fare of 55 cents, as against the steam-road fare of 50 cents, carried many more passengers than the steam road. These instances show the advantages of quick and frequent service. Instances are not wanting to prove that passengers on electric roads are willing to pay the same fare that steam roads charge, the best evidence being that steam roads have reduced their fares in an unsuccessful effort to compete with the electric roads. The fact is, other things being equal, passengers prefer electric roads, and this preference is shown many times where other things are not equal. No one ever heard of a person asking visitors to take a ride on a steam road for fun, but thousands of dollars are spent every year by people riding on electric roads for pleasure. But these advantages of an electric road in passenger transportation do not extend to hauling low-class freight and besides there are specific arguments against the latter business. The very life of an electric road depends on the cars going through the busy parts of the cities and villages on its line, and it is almost the universal custom for the councils in cities and villages to insist on a girder tram rail or a girder groove rail where streets are paved. This makes the adoption of a special wheel necessary, and suburban roads are driven to use a small flange and a narrow tread. It was only by working a small flange that was on a wheel, and finding it much safer than the large flange half worn, that the electric roads could persuade themselves that the small flange was the proper thing for high-speed suburban cars. Most of the suburban roads are laid with T-rail outside of the cities, but there would be very little freight to be hauled between the outskirts of one city and the outskirts of the next one.

While it is believed that the package freight has gone to the electric road to stay, it can be readily seen that if there was enough of it to produce congestion the great advantage of quick handling might be lost. It will be many years before the well-located suburban roads can work up the legitimate passenger business that is in sight. Most of them have so far been contented with such business as comes to them, but by proper effort this business can be increased many fold, especially in the summer time. It will require, however, undivided attention to the needs of the people and attractions in the way of parks and resorts. The quicker the suburban roads quit talking about hauling low-class freight the better for them.



Model for Showing the Disturbing Influences of a Locomotive's Reciprocating Parts.

Disturbing Influences of a Locomotive's Reciprocating Parts.*

It can be shown by calculation[2] that, of the disturbances set up in a locomotive by the unbalanced moving parts, only two are of importance: the rotation about the vertical axis through the center of gravity and the oscillations in the fore-and-aft direction at each reversal of stroke. The magnitude of these disturbances can be calculated by applying the law of conservation of energy, and with a well designed locomotive properly counterbalanced they are practically negligible. They limit themselves and are independent of the speed. For example, a 4-6-0 high-speed locomotive with 20 per cent. of the reciprocating parts balanced gives a rotation at the end of the frame of only about .16 in.

The model shown in the illustration was made for the Berlin Technical School for the study of these disturbances. It consists of a frame hung from the four corners, and carrying a pair of wheels on an axle, which has four cranks. These cranks can be coupled by connecting rods to four pistons working in horizontal guides. Two of the cranks are outside and two inside the wheels, so that the model can represent a two-cylinder outside connected engine, a two-cylinder inside connected engine or a four-cylinder engine.

In the illustration the outside pistons are connected up and the other two pistons and connecting rods are shown in the foreground. The linear scale of the model is about one-tenth full size. The pistons each weigh about 7 lbs., or about 7.5 per cent. of the weight of the whole frame which with two pistons weighs about 90 lbs. In an ordinary locomotive this relation will be about 660 to 110,000, or 0.6 per cent. The reciprocating parts of the model are purposely given an exaggerated weight to increase the disturbing effects and render them readily discernible. In order to show them still better, pointers are arranged for the rotation about the vertical and for the fore-and-aft movement, which multiply the motion in these directions three times. At the other end is a pencil which records the disturbances.

The wheels have the rotating weights of the cranks and connecting rods permanently balanced, and further balance weight up to half the weight of the reciprocating parts can be added as desired. The axle is rotated by a cord from the hand wheel lying below.

At a fairly high rate of rotation the small incidental vibrations disappear and the regular oscillations corresponding to the theoretical considerations appear. The fore-and-aft movement amounts to about ¼ in., and the rotation of the pencil about 0.22 in.

The former is practically the same as is found by calculation while the rotation is somewhat higher, from some as yet unexplained cause. The magnitude of both movements is independent of the speed.

With the two inside pistons connected instead of the outside, the fore-and-aft motion is the same, but the rotation is reduced to about one-quarter its former magnitude. This corresponds to the fact that the distance between the pistons is reduced from 8 in. to 2 in.

With all four pistons connected up, so as to represent a four-cylinder locomotive, the fore-and-aft movement disappears almost entirely while the rotation is about $^3/_{16}$ in., or three-quarters of that observed with the two outside cylinders alone.

This corresponds with the calculations, for the inside cylinders oppose the effect of the outside cylinders, but with only one-quarter the lever arm. In practice the rotational effect on an actual locomotive would be only about half so great for a four-cylinder locomotive as for an equally powerful engine with two outside cylinders, because the weights of the moving parts would be about one-third lighter than for the two-cylinder engine.

Experiments with the model prove that the movements of the engine are small and self-limited vibrations, the period of which coincides with the time of one revolution of the driving wheels. Their magnitude is independent of the speed of the engine so that they do not throw any difficulty in the way of designing locomotives for extremely high speeds. The widely spread opinion that these vibrations increase with the speed is incorrect. This opinion is probably due to a confusion of the "boxing" of a locomotive with the rotation due to the reciprocating parts. This "boxing," or swinging of the locomotives from side to side on the track, has a longer period than the rotation. It begins at a certain speed, and increases rapidly. In order to differentiate between this movement and the rotation proper, the time of a revolution must be noted as the period of the rotation will coincide with this.

When a locomotive is running, the fore-and-aft movement takes full effect, as there is practically no resistance opposing it. With reciprocating parts weighing 660 lbs. on each side, 20 per cent. of this being balanced and a driving wheel diameter of 86.6 in., speeds of 62, 75, and 93 miles an hour will correspond to 240, 300 and 360 revolutions per minute and with a stroke of 23.6 in., the maximum forces in the fore-and-aft direction will be respectively 10,160, 15,800, and 22,900 lbs., which on each

*Abstract of paper by Geh. Reg. Rat Prof. v. Borries, presented before the Verein fuer Eisenbahnkunde Oct. 13 and the Verein deutscher Ingenieure, Oct. 27, 1903. [2] See Glasers Annalen Sept. 9, '99, p. 137; Zeitschrift des Vereins deutscher Ingenieure, 1902, p. 1349.

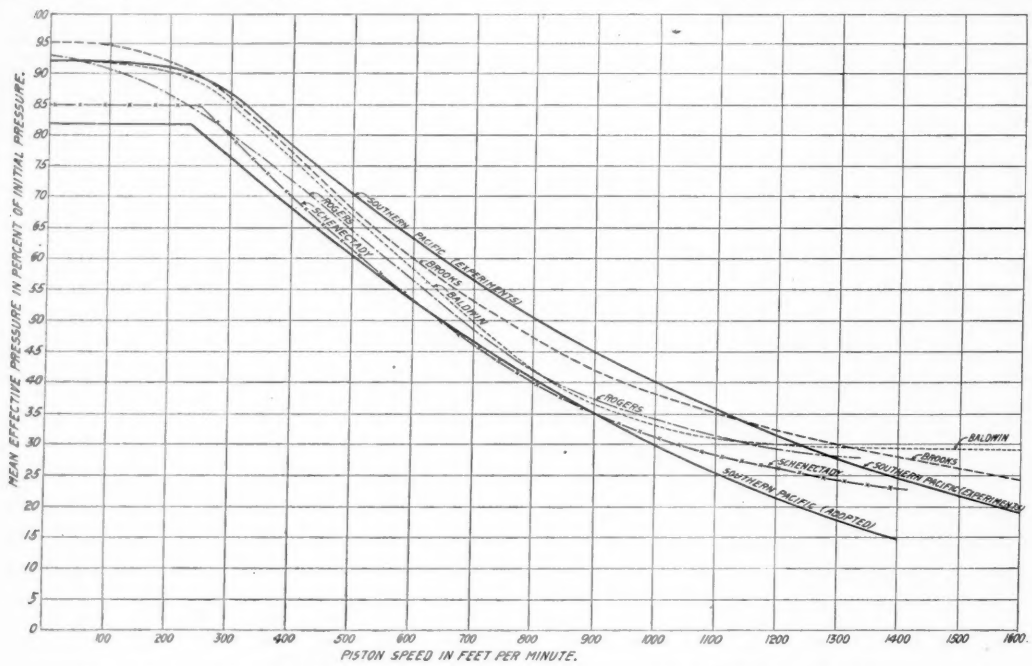
side are set up once in each direction during every revolution. It is obvious that those rapidly varying forces strain the whole locomotive and particularly its coupling with the tender, and their effect is to set the whole vibrating. The fore-and-aft movement is therefore not so harmless as it might appear, and the fact that it is avoided in the four-cylinder locomotive gives this machine one of its most important advantages.

If when working with two pistons sufficient counterbalance is introduced to balance fully the weight of the reciprocating parts, the fore-and-aft oscillation and the rotational movement disappears, but excessive vertical stresses are set up which would in practice be carried by the track.

The Relation of Mean Effective Pressure to Initial Pressure in Locomotives.

One of the subjects which the committee of the Master Mechanics' Association on Tests to Determine Locomotive Performance, included in its list suggested for investigation by tests and experiments, was a determination of the relation between boiler pressure, initial cylinder pressure, mean effective pressure and piston speed. Such data as now exist on this subject have been expressed in the form of curves in which mean effective pressure in per cent. of initial pressure is plotted against piston speed in feet per minute. All of the locomotive builders have such curves for frequent reference in making calculations. Some of the railroads have also derived similar curves.

In the diagram presented herewith the curves of the Brooks, Rogers, Baldwin and Schenectady works and of the Southern Pacific Railroad are shown. One of the Southern Pacific curves shows the results derived from experimental data, and the other, with uniformly lower values, is the one adopted by the road as more



Curves Showing the Relation Between Mean Effective Pressure and Piston Speed in Locomotives.

nearly corresponding to actual working conditions. Each curve in the diagram represents a combination of individual curves obtained for different cut-offs, the object being to have one curve answer all purposes, as being more convenient for general use. However, the general curve does not represent an average of the individual curves, but rather what is considered, or found, to correspond to the best working conditions. In most cases, probably in all, the individual curves were obtained from a large number of indicator diagrams taken at different times and under various conditions, the plotted lines showing best average results.

Other data of this nature on record are found in the 1897 Proceedings of the Master Mechanics' Association in the report on proper ratios of grate area, heating surface and cylinder volume.

Trade Union Outrages in October.

Manchester, N. H., Oct. 1.—In a fight between striking employees of the Crafts Shoe Shop and the men who have taken their places, knives are drawn and shots are fired.

New York, Oct. 1.—Four housesmiths employed on a Broadway apartment house are attacked by eight members of Sam Parks' union, and one of them is severely beaten and taken to a hospital.

Oct. 1.—Eugene Dormody, a non-union driver for the United Trucking Company, is beaten by three men, who jump on his truck and escape without arrest.

Kansas City, Mo., Oct. 1.—W. B. Francisco, in charge of a dry goods company's wagon, is stopped in Park avenue by three strikers, who try to force him to leave the wagon. On his refusing to do so, the strikers attempt to pull him from the seat, whereupon Francisco fires a revolver at short range, hitting Bennett, one of the strikers, in the stomach. The other strikers escape, and no one appears at the police station to prosecute Francisco.

New York, Oct. 5.—The Morse Iron Works and Dry Dock Co. closes because through strike after strike of its working men it could no longer guarantee when work would be turned out, and had lost its patronage. Mr. Morse says that a year ago they found the workmen loafing and sleeping on the steamship "Styria"; the men openly boasted they had not lifted a hammer during the day, and that their organization was so strong that they did not have to work unless they so desired. The foreman was removed and a trusted man put in his place, whereupon a strike was ordered in all the works. Forced to give in because of millions of capital at stake, the foreman was discharged; from that time on the unions owned the works and drove them out of business.

Oct. 6.—James C. Dawson, a glass worker who had remained out with his fellow strikers but found himself falling behind in rent and grocery bills, being unable to maintain his large family and himself upon the $3.00 a week allowed him by the union, returns to work. Four pickets immediately laid in wait for him, and notwithstanding his plea that his wife was ill and his children destitute, set upon him and beat him.

St. Paul, Minn., Oct. 7.—Owners of flour mills complain of violence on the part of pickets posted by striking mill employees and are granted police protection.

Columbus, Ohio, Oct. 7.—Strikers on the King, westside sewer stone the men who took their places, off the premises.

Brooklyn, N. Y., Oct. 9.—Daniel Splain and Mark Wood are fined $25.00 each for assaulting William Stiehl, who had worked at a box factory where they had gone on strike.

Kansas City, Mo., Oct. 10.—Robert Schoemann, a non-union tailor, while on the point of closing his shop, is detained by four men, all non-union tailors, who chat with him in a friendly manner, but as soon as he turns his back, assault and badly beat him.

Minneapolis, Minn., Oct. 14.—Assaults by strikers upon the workmen at the mills have become so numerous that the proprietors ask protection from the Chief of Police. Walter Billings, a striking employee, is arrested for being one of a crowd of strikers who assault John C. Burke and T. H. Pfeil, two of the men who continued at work.

Philadelphia, Pa., Oct. 14.—Frederick Nuttall is held for assault and battery at the instance of John Doyle, who accuses Nuttall of having beaten him and fractured his nose because he continued at work during the recent strike at Dobson's Mill.

Waco, Texas, Oct. 14.—W. H. Hatfield, a street car employee, is assaulted by John Tennyson, a strike sympathizer, and S. A. McCann is arrested for shooting at Tom Hooten, one of the street car guards. A stick of dynamite is found on the street car tracks, with the fuse lighted.

New York, Oct. 14.—Union tailors gather around a Fifth avenue shop and interfere with the non-union workmen to such an extent that the police are called.

New York, Oct. 16.—Emma Schwartz, a leader of the Rag Sorters Union, led an assault on some of the non-union employees of a rag dealing firm, and in the melee knives are drawn, pistols are fired and several persons are hurt.

Newark, N. J., Oct. 18.—Three of the leaders of the strike at the leather factory of Blanchard Bros. & Lane are arrested for assaulting James Donohue, a workman in the factory. Donohue was struck in the head with a piece of iron and gashed in the face.

El Paso, Texas, Oct. 18.—As a result of the Pacific Express strike, an express messenger on a Texas & Pacific train is taken off his car.

Chicago, Ill., Oct. 20.—Rand, McNally & Co. abandon their plan to erect a new building in Chicago and decide to remove their printing plant from the city, Mr. McNally saying that they were either obliged to move or go out of business, as the demands of the trades unions rendered them unable to compete with other publishing firms within a radius of 500 miles of Chicago.

New York, Oct. 21.—Eight union working men attack John Rouan and John Reese at Hudson Heights and leave Rouan for dead in the roadway.

Waco, Texas, Oct. 22.—A street car operated by non-union employees is fired at from ambush by the striking street car men, the motorman and a companion being killed instantly.

Columbus, Ohio, Oct. 23.—Charles F. Weaver, a non-union machinist, who together with Elmer Hall is attacked by three members of the Machinists' Union and struck a severe blow over the head, draws a revolver and fires at his assailants, killing Van Lear L. Oldroyd, Secretary of the Machinists' Union.

Incidents of attack on non-union workmen during the Hocking Valley strike which preceded this tragedy are as follows: William Emmitt while near his home in Park avenue was hailed by some men who were following him. He went back to them and while they shouted "scab" assaulted and beat him almost to death.

George Hare, who refused to obey the warning of the strikers to quit work, is assaulted by four of them who called him a scab.

H. C. Calhoun and George Finney are egged while on the Mound street bridge, and Calhoun subsequently had stones thrown at him.

J. Schart is followed by about 25 men and because he thrust his hand into his pocket as if to draw a pistol is called a coward and stoned. One of the stones struck a woman and another smashed a grocery sign.

Eric Herspool is called from his boarding house and assaulted. He became frightened and left the city.

George White, A. L. Barrett and Robert Rogers, after being driven from one boarding house to another and threatened with assault, give up their jobs and leave the city.

James Weatherwax and a man named Kokenderfer do likewise, because they are told that if they did not do so, they would be taken out piece by piece.

Rochester, N. Y., Oct. 23.—Macy O'Hallock is arrested for throwing an egg at a machinist who carries a sign advertising a non-union establishment.

New York, N. Y., Oct. 24.—Frederick Rochon, a contractor, disappears from his home. His wife says that strike after strike affected the contracts taken by him until he was reduced to penury and fell into melancholy.

Oct. 28.—At a meeting of the Stonecutters' Union a member asks why he was compelled to quit work and given no money, although he has eight little children and not a cent in the house to buy a meal for them.

Kansas City, Mo., Oct. 29.—In a fight between union and the non-union wagon drivers, at the Santa Fe freight house, one of the drivers receives a blow in the face that split his lip.

New York, N. Y., Oct. 30.—John Miles, a printer, goes into the Vernon Avenue Police Station saying that he was starving. Up to last spring he had had a good job but was ordered on strike, then when straitened he returned to work and was expelled from the union. Later when strike was settled he lost his position because he was a non-union man, and was unable to find another, and finally became homeless.

Requirements for Tank Cars Running Over the Pennsylvania Lines.

Following the adoption as Recommended Practice by the Master Car Builders' Association of the committee report on specifications for tank car equipment which was presented at the convention last June, the Pennsylvania Railroad has issued a general notice from the office of the General Superintendent of Transportation governing the acceptance of tank cars for transportation over the company's lines. The notice is dated September 21 and the specifications given in it are to take effect from July 1, 1904. The following extracts cover the important requirements.

General Specifications.—Tank cars which have been in a fire must be withdrawn from transportation service.

Each truck must have a strength equal to or greater than the strength of the axles used. Table below specifies maximum weight of loaded car which can be used with various designs of axles.

Size of journal.	Min. journal dia.	Min. dia. wheel fit.	Dia. at center.	Max. weight of loaded car, lbs.
3¾ x 7	3¼	4¾	4⅛	66,000
3¾ x 7	3½	5	4¼	76,000
4¼ x 8	3¾	5¼	4½	86,000
4¼ x 8	3¾	5½	4¾	96,000
5 x 9	4½	6¼	5⅜	132,000
5½ x 10	5	6¾	5⅞	161,000

The car must be equipped with sufficient handholds and side hand railings, and with steps and push-pole pockets at each corner.

Each car must be equipped with air-brakes of a capacity equal to 70 per cent. of the light weight of car, and at least one hand brake, operating brakes on both trucks.

The tank must be tied to the frame by at least four straps, in addition to a dome yoke. The section area of straps and threaded ends must be at least ¾ sq. in. The straps must be secured through the frame of the car.

Tanks must be carefully inspected and tested with cold water pressure at least once in five years. The test for

new tanks should be at 60 lbs. per sq. in., and for old tanks at 40 lbs. per sq. in., which they must stand without leaks or any evidence of distress. This inspection and test must be made by tank car owners. Tanks, when tested, must be stenciled with pressure applied, date and place where test was made, and by whom.

New tanks must be designed for a bursting pressure of not less than 240 lbs. per sq. in.

All tanks carrying inflammable or volatile material, such as crude petroleum, fuel oil, naphtha, benzine, kerosene, illuminating oils, petroleum products, turpentine, gas liquor, ammonia liquor, coal tar, etc., must be equipped with 5 in. safety valves of approved design; one valve for a capacity of 6,000 gallons or less, and two valves for a capacity of more than 6,000 gallons. Where one valve only is used it must be set to open at a pressure of 8 lbs. per sq. in.; where two valves are used, only one must be set to open at 8 lbs. per sq. in., and the other at 12 lbs. per sq. in.

Tanks carrying non-inflammable or non-volatile material, such as sulphuric acid, vinegar, linseed oil, cottonseed oil, lard oil, fish oil, tannery products, glucose, molasses, calcium chloride, caustic soda, silicate of soda, etc., need not be provided with 5 in. safety valves, but each tank should have a small vent or valve.

Tank heads, if less than $^{7}/_{16}$ in. thick, should be reinforced at bottom by means of steel plate shoes $\frac{5}{8}$ in. thick, securely riveted to the bottom of each tank head, to prevent damage due to impact against head blocks.

Dome heads and lids must be made of either cast or pressed steel or malleable iron.

Old Tank Cars Having Wooden Underframes.—No tank car of wooden underframe construction, of railroad, foreign or individual ownership, will be accepted for service on these lines, unless modified so as to conform to the general specifications given above, in addition to the following detail specifications:

The underframe must have two center sills, each not less than 5 in. wide by 10 in. deep, and spaced not more than 18 in. apart. Where draft timbers are below center sills the space between center sills must be filled in with timber not less than 10 in. deep, extending from each end sill to nearest crossbearer or cross timber, provided the latter is located not less than 5 ft. from center of bolster. Center sills and filling timbers must be securely bolted together by means of $\frac{3}{4}$ in. bolts. End sills must not be less than 9 in. wide by 10 in. deep.

Draft sills secured to inside of center sills and extending to crossbearer, or cross timber, will be accepted as a substitute for filling timbers. Draft sills must not be less than 4 in. wide by 8 in. deep, and each draft sill must be held to center sill and end sill by means of seven or more $\frac{7}{8}$ in. bolts. Draft sills extending to cross-tie timbers must be secured to center sills inside of bolster by additional bolts.

In all draft gear and draft attachments, tail yokes must be used, and tail bolts or straps will not be accepted.

Head blocks must be not less than 10 in. x 10 in., cut out to suit curve of tank and supported at the center by means of a substantial casting, which must be securely bolted to center sills and end sill, and, in addition, must butt against the inner face of end sill. The ends of each head block must be tied to corresponding ends of the head block at other end of car, by means of rods not less than $1\frac{1}{8}$ in. in diameter. Each head block must also be bolted to the underframe by means of not less than six $\frac{7}{8}$ in. bolts. Any other means of securing head block, equally as strong as that described, will be accepted as a substitute.

New Tank Cars.—No tank car built after July 1, 1904, shall be accepted for service on these lines unless equipped with steel underframing or with reinforced shell. The design must be submitted to and passed upon by the Mechanical Department.

New tank cars must conform to general specifications given above, in addition to the following detail specifications:

The center sill construction of the underframe, between bolsters, must have an area of at least 30 sq. in.

Each car must be equipped with some form of friction draft gear, with steel couplers and steel body and truck bolsters.

All longitudinal and head seams must be double-riveted.

If the car has no underframe the tank shell at bottom must be at least $\frac{5}{8}$ in. thick, and all circumferential seams must be double-riveted. The additional metal added to bottom of tank shell must be at least 20 sq. in.

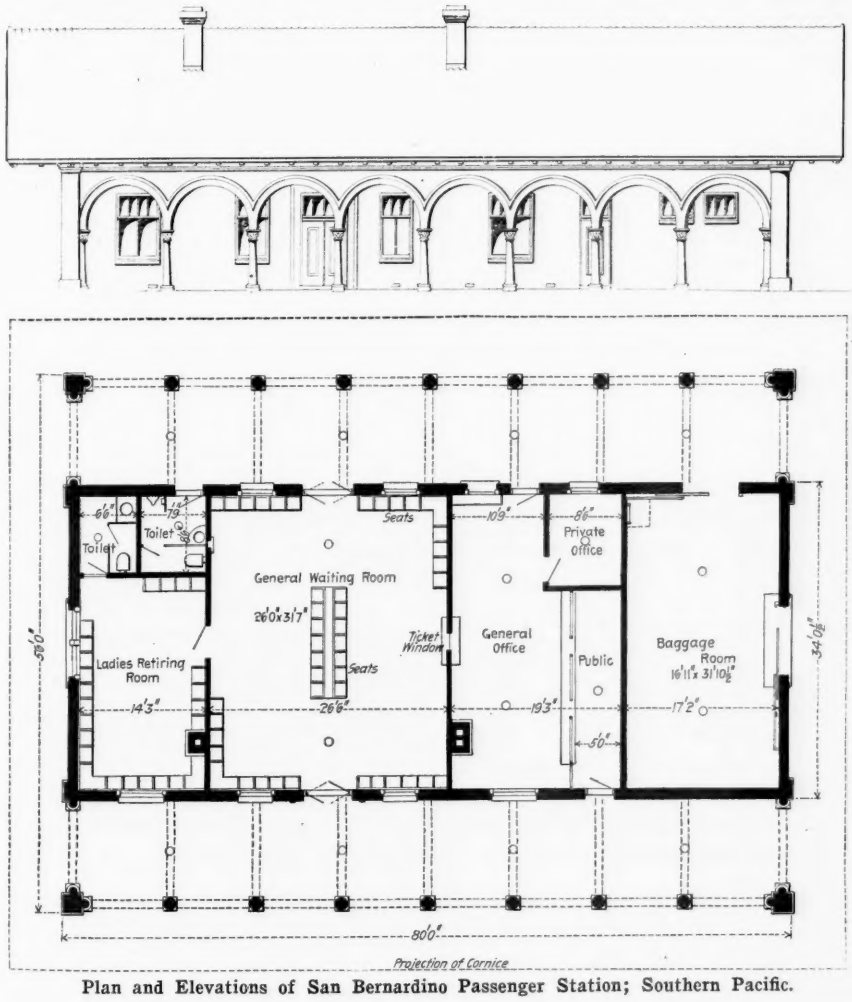
Southern Pacific Improvements at San Bernardino.

The Southern Pacific is making some improvements at San Bernardino, Cal., which include a change of alinement in entering the town, and the erection of a new passenger station and freight house.

The new passenger station, though small, will be quite attractive in appearance. It will be in Mission style, with tile roof, and will have arcades, at both front and back. It will be 80 ft. long, 34 ft. wide over side walls, and 58 ft. wide over arcades. The cornice will project 6 ft. beyond the building line on all four sides. The building will be of buff-colored pressed brick and ornamental brick, with columns of the same material. The roof, which will have a $^{1}/_{5}$ pitch, is to be of semi-glazed Ludowici tile.

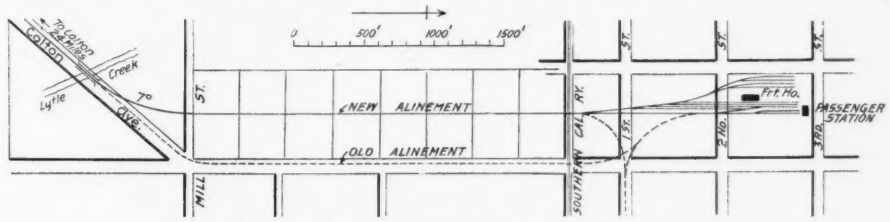
The interior will be divided into baggage room, 16 ft. 11 in. x 31 ft. 10 in.; offices, 19 ft. 3 in. x 31 ft. 10 in.; general waiting room, 26 ft. x 31 ft. 7 in.; ladies' retiring room, 14 ft. 3 in. x 23 ft. 4 in., and toilet rooms which occupy the remainder of the width not taken by the ladies' retiring room. The interior finish in the offices and waiting room is to be plaster walls above a hardwood wainscot, and a plaster and wood-beam ceiling. The arcades also have beam ceilings. The ladies' retiring room will have a cove ceiling, while the ordinary tongued-and-grooved material will be used for the baggage room. Combination gas and electric fixtures will be provided for lighting. The arcade platforms are to be of decomposed granite and the walks around the grounds will be asphalt. The grounds will be laid out with ornamental shrubbery.

The freight house will be a wooden building, 30 ft. x 120 ft., with the necessary loading and unloading tracks, ample platforms, and four team tracks at the rear.



Plan and Elevations of San Bernardino Passenger Station; Southern Pacific.

The previous entrance was along E street, and thence with a reverse curve to the main yard and passenger station, which faces on Third street, the main business street of the town. E street is a main thoroughfare between San Bernardino and Colton, along which there is much pedestrian and carriage traffic; there is also an electric car line. The accompanying map shows the change by which this street is avoided, a straight line into town obtained and yard expansion facilitated. The new line starts from the north (city) end of Lytle Creek bridge on a 7-deg. curve and is something less than a mile long. Enlargement of the yards will be included in the new track work.



New Line of the Southern Pacific into San Bernardino.

Locomotive Frame Design.

In discussing the paper on "A Rational Method of Design of Locomotive Frames" (*Railroad Gazette*, Oct. 9,) presented to the September meeting of the Pacific Coast Railway Club, Mr. D. P. Kellogg, General Foreman, Machine Department, Southern Pacific, said: It seems to me that the steel casting, as we have found it, so far in our experience, is hardly applicable to the engine frame. If there is any part of a locomotive that should be solid and well-designed and properly fastened, it is the frame. I was talking with a prominent steel foundry man in St. Louis a little over a year ago, who started to make steel castings for locomotive frames, and I asked him his private opinion on the subject. Although he was selling frame castings, he told me he did not believe that anywhere in the near future we would be able to produce a successful steel casting for locomotive frames; he said their experience as a manufacturing concern had been very costly, as they had made 26 defective frames to get one perfect casting; they had cast 26 castings, which had been rejected, to obtain one which was good. Even smaller steel castings are not reliable. We do not find steel of any kind uniform. As to the I-section frame, there are a great many disadvantages to be encountered in placing and machining it, and hanging other parts to it. If it is broken, it is a much harder job to weld it and it must be milled out again.

I agree that a rational method of design for engine-frames is sadly needed. There does not seem to be any uniformity of practice among locomotive builders as to the sectional area required for certain weight locomotives, or in the placing of wheels. We have 10-wheel engines in service with 18 in. x 24 in. cylinders, weighing 80,000 lbs. on drivers, having a lighter frame or section of frame than engines with 16-in. cylinders and weighing 45,000 lbs. on drivers. In noting the causes of breakages, especially in the last few years, I have had opportunity to examine some 125 or 130 cases. We find that the frame usually breaks through the bolt holes where it has been weakened by bolting on a hanger or some other part of the frame; this is because the frame has not been strengthened at that point for that purpose; and it seems as though the builders might do a great deal in that respect. If they would strengthen the frame at the points where they expect to drill a number of holes, that portion of the frame would be as strong as any other portion. Again, we find a great many breakages occur at the welds, and it is not always the weld itself that breaks, but a section showing iron of cross grain. We also have frames break where the equalizer hangers chafe.

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.
PUBLISHED EVERY FRIDAY
At 83 Fulton Street, New York.

EDITORIAL ANNOUNCEMENTS.

CONTRIBUTIONS.—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

The summary of trade-union outrages during October, published in this issue of the *Railroad Gazette*, in addition to the customary list of murders, assaults and cases of trade-union members who have been reduced to destitution and driven to crime by not being allowed to work, includes the closing of a ship-building establishment which had done a prosperous business and maintained an extended pay-roll through many years, but by yielding to trade-union demands had become so subject to labor tyranny that it was forced completely out of business. Another instance is of one of the best known publishing establishments in the United States abandoning plans for a million dollar plant in the city in which it has given employment to thousands of men for half a century because the demands of the labor unions have made it unable to compete with similar establishments in other cities not so hampered. There were many cases such as these in the high tide of our prosperity. That they should continue into what is admitted to be a period of hesitation and doubt, when all of the industrial forces need to work together for the protection of the community, is but another proof that the action of corporate officers employing labor should be based on principle. A trustee cannot, legally or morally, abandon his responsibility and delegate his trust to another. A workman has a right to dictate his price, hours and conditions of working, but anything further than this is not minding his own business. A large proportion of the labor-union demands are for specific control of some department of management; for example, piece work, shop regulation, double-heading, the right of non-union men to work, and many other economic and humane questions. Adherence to principle in small cases as firmly as in large ones, and an enforcement of the laws, will cost some money and some lives. A period of lessened demand for workmen gives a chance for officers to deal kindly and considerately with their men and to unswervingly do their duty.

Elsewhere in this issue is a diagram showing the curves of four locomotive builders and one large railroad system—the Southern Pacific—for use in calculations involving the relations of mean effective pressure, initial pressure and piston speed in locomotive cylinders. The committee of the Master Mechanics' Association on Tests to Determine Locomotive Performance recommended this as one of the subjects for experiment and test, and the curves are exhibited as representing present existing data on the subject. Placing them on one diagram enables close comparison to be made, their differences at once being apparent. Take for instance the variations at 600 f.p.m. There is a difference of 6½ lbs., or 12 per cent., between the lowest and highest curves, not including the experiment curve of the Southern Pacific. At 1,200 f.p.m. this difference has increased to 10 lbs., and the percentage to 44. In explaining the conditions governing the derivation of the curves it is stated that in most cases, probably in all, they were obtained from a large number of indicator diagrams taken at different times and under various conditions, the plotted lines showing best average results. Since any one of these curves represents average results only it is, of course, only approximately applicable to particular cases or conditions and is therefore lacking in value to the degree that it falls short in any particular case. Tests to establish the relations suggested by the committee would need to cover a wide range of conditions, and should include all of the important types of locomotives and important designs of each type, operated under all the varying conditions encountered in service. The results for each design of each type should be recorded separately, if sufficient variation between designs is disclosed, and the records should include the essential dimensions of the locomotives such as boiler capacity, cylinder capacity, port area, etc. Furthermore, tests on the Purdue locomotive have shown that the mean effective pressure depends largely on valve proportions and setting. It therefore follows that no information on this point can be definite which does not define the valve action; but this is a matter of some complication. The recommendation of the committee includes the relation to boiler pressure as well as to initial pressure. The former involves two things: first, the loss of pressure in the pipe connection between the boiler and the valve chest, and second, the loss in passing the valves and ports. On the Purdue locomotive the first has been found to average five or six pounds with a full-open throttle.

The Chief of the Brotherhood of Locomotive Engineers, after an interview with Mr. F. A. Delano, General Manager of the Chicago, Burlington & Quincy, makes an announcement which recalls an incident never to be forgotten by the members of the Brotherhood and the older officers of the Burlington:

> From this time on there shall be no discrimination in any form against men who join the Brotherhood, but they shall be left entirely free to join or not as they may elect. While on our part, we are not to seek by force to compel engineers to become members, or to uphold those who do become members in vicious or careless work, or in becoming agitators or in deviating in any manner from the work that ought to be done by a faithful and consistent employee of the company, and every one who joins must stand or fall strictly upon his own merits as a man, as members of the order must elsewhere. As part of the agreement the Burlington Relief Association is not to be antagonized.

The great Burlington strike began on Feb. 27, 1888, and every engineman except one left his cab. The tie-up was as sudden and as complete as if the track had been swept away, but the company found little difficulty in filling the vacant places with men of varying degrees of competence and character. Indeed, it became early apparent that there were plenty of men outside of the brotherhood capable of running the Burlington locomotives provided they were not violently interfered with. But other employees struck in sympathy, and the managers of connecting roads weakly refused to accept freight from the Burlington under threat from their own employees—members of the brotherhoods. The courts compelled the connecting roads to do their duty, and then violence began. The brotherhood engineers maintained a dignified and decent attitude until they saw misery and the loss of a chance to make a living plainly confronting them. The late P. M. Arthur exerted all of his great influence to hold his men to a due regard for the law; but in this he was generally unsuccessful, as might have been expected. For when any great body of men see their chances for a livelihood slipping away from them they are not apt to be orderly; but, imbued with a sense of injustice, they are quite certain to be disorderly. There were months of real war; the disabling of engines with sal soda and emery and other ingenious methods, the destruction of track, the use of dynamite, brutal beatings and murders. Nevertheless, the company won the battle, and, substituting new men for the old ones, thousands of trained, able men were left homeless wanderers. Time alone can heal such wounds as these, and in this case it has needed fifteen years for the bad passions to subside and lead to the formal, simple announcement which is quoted above. It is indicative of our swift way of living that this declaration of peace should escape the attention of the daily newspapers.

Locomotive Tests at St. Louis in 1904.

Those interested will find the first bulletin, which will be published in full next week, a document of unusual interest. The committee show a keen knowledge of the fundamental principles which control the operation of the locomotive; and their definite instructions promise results of the highest importance in determining the economy of different types of locomotives so that accurate comparisons can be made under all conditions of operation within the capacity of each machine. The bulletin defines the responsibilities of all concerned with the tests; it specifies the types of locomotives which are to be tested; it describes methods which are to be followed in making tests; it presents a plan of publication of the results and it defines the nature of the tests.

The testing plant is now being designed by the Pennsylvania Railroad Company, and a description of it is soon to be published. When the Pennsylvania first announced its intentions, we commented on the practicability of the scheme, and gave some reasons why the stationary plant was best adapted to the work. It may still be urged by some that results from tests in the laboratory do not check results obtained on the road, but it cannot be justly said that the testing plant does not give correct comparative results. The utility of the stationary plant for determining fundamental principles and for noting the effects of changes in design upon the operation or economy of the locomotive has already been proved by Prof. Goss in his tests on the experimental locomotive at Purdue. The American Society of Mechanical Engineers has also formulated a standard code for testing locomotives, and this code will be followed, in the main.

The types of locomotives selected for test cover all the important features of modern locomotive practice. The ultimate comparisons between simple and compound locomotives, narrow and wide fire-boxes, long and short tubes, two-cylinder and four-cylinder compounds, etc., will settle a lot of questions not clearly understood at this time. The comparisons between foreign and American locomotives will also disclose the points of superiority of one design over the other. Frequent references have been made to the excellent performance of French and English locomotives in fuel economy, cylinder efficiency and evaporative power per square foot of heating surface. Recent road tests on the Furness Railway in England with a simple locomotive having 18 in. x 26 in. cylinders, 1,134 sq. ft. of heating surface and 150 lbs. boiler pressure, showed that the steam consumption per indicated horse-power per hour averages about 20 lbs. This figure is about 20 per cent. less than that usually quoted as the best performance of American simple locomotives. The quality of coal used in the English tests was very good, averaging about 14,000 thermal units per pound, and the rate of evaporation did not exceed 9½ lbs. of water per sq. ft. of heating surface per hour, all of which tends to give very dry steam, which in turn improves the cylinder efficiency. Furthermore, the clearance spaces in the cylinders of the locomotives are very small, the valve seat being only 2½ in. from the nearest point on the circumference of the piston. These tests are only cited to show that American designers may have much to learn from foreign designs. It is also possible that such excellent results are due to conditions not indicated by the report of the tests. Such apparently simple matters as the type of indicator used on the cylinders or the length of the pipe connecting the cylinder and the indicator, may introduce errors which seriously affect the results and give rise to false comparisons. Such errors will be eliminated in the coming tests.

The bulletin has diagrams which show the conditions of running each series of tests. These afford a graphic means of considering different tests at a glance, provision being made for the principal functions of the boiler and cylinders of a locomotive. Except at very short cut-offs the cylinders of a locomotive are capable of using all the steam which can be evaporated by the boiler. Assume that a locomotive of the following general dimensions is on the testing plant:

Total weight, lbs.	85,000
Weight on drivers, lbs.	56,000
Diameter of drivers, in.	63
Cylinders, in.	17 x 24
Heating surface, sq. ft.	1,214

Assume that the reverse lever is placed so that the

cut-off in the cylinders is about 6 in. The load on the brakes is released, and the throttle is slowly opened. The drivers start to turn on the supporting wheels and the speed increases. When the throttle is wide open, the water pressure is turned on the brakes, thereby increasing the load and reducing the speed to about 80 revolutions a minute. The speed can then be maintained constant, and a test can be run. The test would show the following results:

Cut-off, in.	6
Speed, r. p. m.	80
Speed, miles per hour	15
Mean effective pressure, lbs.	44
Evaporation by boiler, lbs. per hour	5,486
Steam consumption per i. h. p. per hour, lbs.	28.9
Total indicated horse-power	190

If now the water pressure on the brakes be released, the speed will increase until, say, the locomotive is making 188 revolutions a minute. A test run under these conditions would give the following results:

Cut-off, in.	6
Speed, r. p. m.	80
Speed, miles per hour	35
Mean effective pressure, lbs.	30
Evaporation by boiler, lbs. per hour	8,051
Steam consumption per i. h. p. per hour, lbs.	26.9
Total indicated horse-power	298

It will be seen that, although the cut-off has been kept at 6 in., the mean effective pressure in the cylinders has dropped from 44 lbs. to 30 lbs. This is due to the "wire drawing" action of the steam in passing through the parts. The horse-power has increased from 190 to 298, and the rate of evaporation of the boiler has increased from 5,486 lbs. per hour to 8,051 lbs. per hour—the increase in indicated horse-power being relatively greater than the increase in the evaporation, which is due to the drop in steam consumption from 28.9 lbs. to 26.9 lbs. per indicated horse-power per hour.

Again, suppose the speed be increased to 296 revolutions a minute by further diminishing the load on the brakes. A test at that speed would give the following results:

Cut-off, in.	6
Speed, r. p. m.	296
Speed, miles per hour	55
Mean effective pressure, lbs.	18
Evaporation by boiler, lbs. per hour	8,840
Steam consumption per i. h. p. per hour	30.6
Total indicated horse-power	292

The evaporation of the boiler has increased to 8,840 lbs., although the indicated horse-power has remained nearly constant. This increased evaporation is due to the rise in the steam consumption per indicated horse-power per hour.

Another similar series of tests can now be run with the reverse lever dropped down so as to give 8 in. cut-off in the cylinders. The following results at the several speeds would be obtained:

Test number	1	2	3
Cut-off, in.	8	8	8
Speed, r. p. m.	81	188	296
Speed, miles per hour	15	35	55
Mean effective pressure, lbs.	62	42	27
Evap. by boiler, lbs. per hour	7,217	11,330	13,912
Steam consump. per i. h. p. per hr.	27.7	26.3	32.0
Total indicated horse-power	270	431	438

The important feature to be noted in the above table is that at a speed of 55 miles an hour (Test No. 3) the evaporation of the boiler is 13,912 lbs. per hour, a figure close to the maximum capacity of the boiler. Any marked increase in speed would result in loss of steam pressure and exhaustion of the boiler.

If another series of tests were now run at a cut-off of 10 inches, it would be found that at 81 revolutions a minute the pressure exerted by the cylinders would cause the drivers to slip—hence no test could be run at that speed and cut-off. At 25 miles an hour a test could be run. At 35 miles an hour (188 r. p. m.) the following results would be obtained:

Cut-off, in.	10
Speed, r. p. m.	188
Speed, miles per hour	35
Mean effective pressure, lbs.	48
Evaporation by boiler, lbs. per hour	14,794
Steam consumption per i. h. p. per hour	30.1
Total indicated horse-power	501

Again, it will be seen that at 10 in. cut-off and a speed of 35 miles an hour, the evaporation of the boiler approaches a maximum, and any further increase of speed would exhaust the boiler.

All of the above data are from actual tests made on the Purdue experimental locomotive and reported in a paper by Prof. Goss before the New England Railroad Club, in December, 1901.

If all the above mentioned tests were plotted with cut-offs as abscissæ and speeds as ordinates, diagrams would be obtained similar to those given in the bulletin. The limiting speeds and cut-offs would, of course, be different for each type of locomotive, but the general plan of the tests would be the same for each locomotive.

October Accidents.

The condensed record of the principal train accidents which occurred in the United States in the month of October, printed in another column, contains accounts of 38 collisions, 25 derailments, and four other accidents. Those which were most serious, or which are of special interest by reason of their causes or attending circumstances, occurred as follows:

	Killed.	Injured.
†2d—Beowawe, Nev.	1	6
5th—Birdseye, Mont.	..	..
17th—Lambertville, N. J.	17	34
18th—Washington, D. C.	1	..
19th—Keysville, Va.	4	4
26th—Orange, N. J.	..	20
27th—Palisade, Nev.	7	5
†28th—Marceline, Mo.	1	20
30th—Fowler, Col.	..	13
†31st—Indianapolis, Ind.	16	30

The Montana accident is remarkable, not by reason of its magnitude but because it was a part of a plot by brigands to "hold up" a railroad company for a large sum of money. According to the newspapers there has since been a similar attack on a railroad in Iowa. The Lambertville collision is perhaps to be classed as an incident of the repair work necessitated by the great flood in the Delaware River, and therefore as a case not to be judged by the strict standards which should govern the management of trains in normal railroading; but there is nothing in the accounts to indicate that the block system could not and should not have been in force at the time and place where the collision occurred. The railroad company on whose line this collision occurred employs the space interval on hundreds of miles; but not, we believe, on this particular line.

The Orange collision is said to have been due to the clearing of an automatic block signal, falsely, by a current from a street-railroad power-line. During the station stop the train that was run into stood partly on a street crossing at which is an electric railroad. There are insulated joints in the rails east and west of the crossing. The signal track-circuit is run around the crossing by underground wires in the usual manner, and the railroad company's rails at the crossing are liable to be charged, and usually are charged, with electricity from the street-car current. It appears that this current was conveyed to the rails behind the standing train, thus closing the magnet at the signal. This foreign current was enabled to reach the rails west of the crossing by the presence of a pair of wheels and an axle of one of the cars which stood so as to make a connection across insulated joints. The joints being staggered, a single axle could connect one of the rails at the crossing with one of those west of it.

The circumstances of the Indianapolis collision were discussed in our issue of November 13. The Coroner's verdict, since received, and printed, in part, below confirms the view of the case that we took at that time. The coroner, taking things as he finds them, and ignoring abstract principles or the lessons of experience as to what are and what are not correct methods, fixes the responsibility where, from the evidence laid before him, it appears that it ought to be fixed, judging by the habitual methods of running trains on this road at this place. He treats the railroad's methods as lawful, as undoubtedly they are; and so, of course, blames the man who varied from those methods. To the railroad officer, however, the question is not so much one of technical responsibility, as decided by lawyers' standards, as of correctness of principle as founded on reason and experience. Looking at it in this light this collision becomes simply a tragic illustration of the futility of depending, for the safety of trains, on a combination of regulations which cannot be satisfactorily defined and are difficult to enforce. At Indianapolis the prevention of collisions depended on (1) the sending by the despatcher to the yardmaster of orders which are not specifically required by the regular printed despatching regulations, and therefore peculiarly liable to be forgotten; (2) on correct time computation or speed control by the men in charge of the yard train, who at the same time could feel that the responsibility chiefly rested, not on themselves, but on the passenger train; and (3) on a reduction in speed, of the passenger train, greater or less according to the circumstances of the view, the light or darkness, and the supposed importance of the train, while at the same time the men in charge, like those in charge of the yard train, had a right to feel that "the other fellows" would take the responsibility. It is not a matter of surprise that such an arrangement breaks down. To say that the regulations are difficult to enforce is in this case the extreme of mildness, for it does not appear that there was any effective provision for enforcing them. Indeed, the actual customary practice, as described by the Coroner, is in itself evidence of disregard of regulations by all concerned. The least that can be demanded by the public, under any plan or method, is that, by regular inspection and test, the officer in charge shall know what degree of obedience his men are giving.

In declaring that the true remedy for collisions is the block system, we have not been unmindful of the fact that on many miles of railroad the block system is in use, to a certain degree, but is not enforced absolutely within yards; there is in force a space-interval rule from station to station, but subject within yards to a speed limit or to rules allowing yard engines to use the main track. It is to be borne in mind that this is not the absolute block system. Every modification of this kind is dangerous. In England, whence we get many of our lessons about spacing trains, the need of having as rigid a rule within yards as at other places has been the burden of many communications from the Board of Trade to railroad companies; and no lesson of experience is clearer than that every foot of a main track should be protected by the same simple and inflexible rule. This lesson has been enforced, over there, by innumerable collisions; is there any need of repeating the process in America?

The essential portions of the Indianapolis verdict, as published by Coroner H. D. Tutewiler, are as follows, slightly condensed:

"Said collision occurred on said main track between Holton place and Northwestern avenue. There was at the time of said collision an ordinance of the city of Indianapolis in full force, providing that engines and cars should not be run in and through said city at a rate of speed greater than four miles an hour, and I find that both said trains were being run at, and for some time before said collision, at a speed greatly in excess of this rate. Said switch engine was being run at about nine miles an hour and said extra passenger train at or about 30 miles an hour.

"One of the rules of said railroad, special rule No. 23, provided that 'trains not scheduled, when permitted to run between North Indianapolis and shops, must keep under control, expecting to find track occupied by yard engines.' The evidence shows that said extra passenger train was not being run under control. But I further find that the train orders under which the extra was being run, fixed the time for arrival at North Indianapolis, North street and the Union Station, and in order to carry out said orders it was necessary to run at a high rate of speed.

"It had been the custom and practice of said railroad company and its officials to protect all extra trains between said North Indianapolis and said Union Station by the Chief Train Despatcher, B. C. Byers, notifying John Q. Hicks, General Yardmaster of Indianapolis, and all yard and switching crews were notified from the office of said Hicks of the time when said trains would be between said North Indianapolis and said Union Station, and said switching and yard crews were required at such time to keep their engines and cars off the main track, including place where said collision occurred, and under this custom and practice I find that the engineer and conductor of extra 350 were warranted in believing that track would be kept clear for their train, and that the train would be protected against all switch and yard engines and cars.

"The evidence shows that said special rule No. 23 was lived up to in its letter only in cases of emergency and was not followed when there was time sufficient to give notice to protect extra passenger trains, and the officials and officers of said road must have known from the handling of extra trains, that said special rule No. 23 was not being complied with, except in emergencies.

"I further find that the chief train despatcher did not notify said Hicks of the time of the expected arrival of said extra trains, and for that reason no notice was given through the office of said Hicks to the switching crews of said extra trains. If the office of said Hicks had been notified it would have been under the custom and practice of said company, the duty of said office to notify the telegraph operator at North street, the switch tenders of said company at Market street and Senate avenue, and the assistant yardmaster at the Shelby street shops, and through them said extra trains would have been protected.

"I find from the evidence that said collision occurred through the failure and neglect of said chief train despatcher to notify the general yardmaster. . . .

"I have found that there was no printed rule requiring said chief train despatcher to notify the office of the general yardmaster at Indianapolis of the expected arrival of extra trains, but I find that it has been the custom and practice to do so."

The number of electric car accidents reported in October was 16, in which seven persons were killed and 57 injured.

Railroad Progress in China.

As American manufacturers are again seeking orders from foreign countries it is of interest to note that railroad building in China is now a business of considerable magnitude. One of the important projects is that for a line from Pekin southward through Hankow to Canton, from Hankow north promoted by a Belgian company, from Hankow south surveyed for American capitalists. From Pekin to Canton is more than 1,300 miles. From Pekin southwest some 80 miles a railroad has been in operation for some years, and for 18 months it has been open to a point about 80 miles further south, to Cheng-ting-fu. Sept. 15 this road was opened to Shunte-fu, 242 miles south of Pekin, and work was in progress on its extension 80 miles further south, while the line was located to the Hoang-ho, 410 miles south of Pekin. To meet it, from Hankow, on the Yang-tse-kiang about 400 miles west of Shanghai, a railroad had been built and was open Sept. 1 186 miles north, to be completed by the end of the year 53 miles further, to Yeng-cheng-sien. Thence north to the Hoang-ho is about 100 miles, including a viaduct 1⅔ miles long. It is hoped to have

the line open through from Pekin to Hankow, about 750 miles, by the end of 1905.

A Belgian company has a concession for a new railroad from Kai-feng to Ho-nan. This will be a branch of the line the Belgians are building from Pekin south to Hankow. Kai-feng is just south of the Hoang-ho (otherwise Yellow) River, and the new line extends thence nearly due west near the south bank of that river 110 miles to Ho-nan. The river is a great one, but apparently even less fit for navigation than the Missouri above Kansas City.

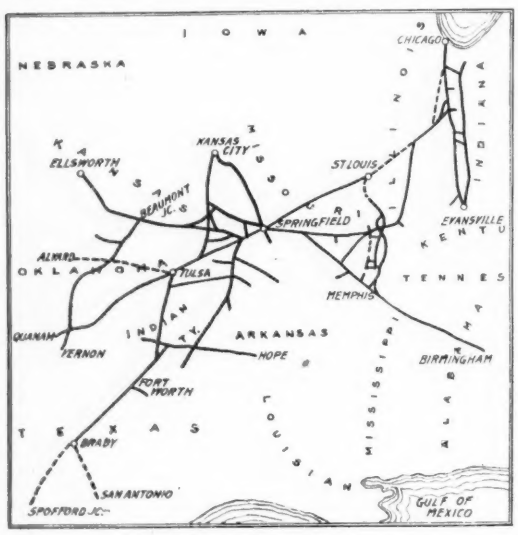
The Chinese policy is to make the Pekin-Hankow-Canton line the great interior trunk line, touching the sea only at Canton, though accessible by ocean steamers at Hankow, 400 miles inland (700 by river). They fear lines from the coast inland as opening the country to attacks from the sea, and hope that a line wholly in the interior will enable them to concentrate their military forces, which is impossible now because foreigners command the sea and the distances are too great for marching by land, especially in a country where there are no roads.

St. Louis & San Francisco.

The full and explicit annual statement for the year ending June 30 presents a moderately good showing, which would presumably be better were it not for the fact that over 500 miles of new railroad was added during the fiscal year, much of it in comparatively undeveloped country. The average mileage operated during the year showed an increase four-fifths as great as this, and amounted to 3,675 miles as against 3,252 in 1902.

Gross earnings showed a good increase from last year and were $24,289,510 as against $21,620,882, but the increase in operating expenses almost equals the gain in gross earnings, and the added charges for interest, rentals, etc., so increased the total charges that the surplus applicable to dividends decreased from $2,277,478 in 1902 to $1,474,717. This is considerably the smallest surplus of the three years since the system has been in approximately its present form, and the surplus out of which dividends were declared in 1901 was almost as much larger than the 1902 surplus as the 1902 is larger than this year. By far the greater part of the new mileage opened during the fiscal year under review is in Oklahoma and Indian Territory, and it is manifestly impossible to judge of its profitableness in its first year of operation; better results may be reasonably expected, following the development of the country. The Southwest at the present time is the portion of the United States where the most important and the most extensive new railroad building is being done, and the additions which the St. Louis & San Francisco and its allied companies have built in Oklahoma, Indian Territory and the northern part of Texas since 1900 aggregate about a thousand miles, or quite a little over 25 per cent. of the total mileage now operated in the system. The property has not reached a state in its development when comparative returns year by year indicate much about traffic density.

In view of the large sums which will doubtless have to be spent on the new lines for some years to come, the percentage of operating expenses to gross earnings, which this year amounted to 65.36, seems high. Last year it was 62.31 and in 1901 it was 59.04. In 1900, with an



St. Louis & San Francisco.

operated mileage of 1,659 miles as against 3,315 this year, operating expenses were only 58.78 of gross earnings.

The items of gross and net earnings per mile of road worked and also the train loading show rather unfavorably; but this results from the large increases in mileage in new territory. The average train load of revenue freight, however, amounted to 195 tons, increasing from 187 tons in 1902 and 188 tons in 1901. The numerous branch lines in the system carrying comparatively light loads tend, of course, to keep the figure down.

The accompanying map shows the general location and direction of the new extensions in operation. The Blackwell, Enid & Southwestern and Blackwell, Enid & Texas lines, forming a continuous line from Blackwell, Okla. T., to Vernon, Texas, 251 miles, were completed and opened last February, and the Oklahoma City & Western and Oklahoma City & Texas lines, forming a connection from Oklahoma City to Quanah, Texas, 183 miles, were opened last March. The line which is shown on the map running across the southern part of Arkansas into Indian Territory is part of the St. Louis, San Francisco & New Orleans, owned by the Frisco. The portion between Ashdown, Ark., and Soper, Ind. T., was turned over by the Choctaw Construction Company in August, 1902, and since that time about 100 miles more has been completed, and the extension through to Ardmore, Ind. T., shown on the map as the terminus, was to have been opened November 1st this year. The broken lines show the projected extension through to Lawton. Four important properties have been acquired since the publication of the last report.

On Nov. 1, 1902, the Frisco purchased from the Missouri & Southeastern Construction Company the entire capital stock of the St. Louis, Memphis & Southeastern Railroad, which when completed will extend from a point near St. Louis, Mo., to Luxora, Ark., 250 miles, with branches bringing the total up to 416 miles, of which something over 300 is now in operation for account of construction. It is expected that the entire line will be completed this year, giving a new and direct route between St. Louis and Birmingham.

In November, 1902, the entire capital stock of the St. Louis & Gulf was acquired. This company has about 265 miles completed, or to be in operation early in 1904, in southeastern Missouri. Last August control of the Chicago & Eastern Illinois was also acquired by purchase of about four-fifths of the capital stock. The net earnings of this property appear in the present report as dividends on stock held. The capital stock of the Ozark & Cherokee Central and the Shawnee, Oklahoma & Missouri Coal & Railway companies was also purchased during the year. The two roads form a continuous line from Fayetteville, Ark., to Okmulgee, Ind. T., 144 miles.

To work all this new territory considerable increases in equipment were necessary, and on June 30, 1903, 586 locomotives were owned, an increase of 14 per cent. over the year previous, and 21,129 freight cars, an increase of nearly 25 per cent., while the increase in the tonnage capacity of the freight cars was almost 33 per cent. The ton mileage density of revenue freight per mile was 476,051 in 1903 as against 503,499 tons last year, a decrease which is perfectly normal under the circumstances. Loaded car mileage increased 3,787,503, or 34 per cent., while the empty car mileage decreased 1,155,231 miles, or nearly 2 per cent.

The country through which the company's line passes has been prosperous during the year, and this prosperity is apparently continuous, with an outlook for a good crop of farm products and an increase in coal production. The territory served by the new lines is not only productive but is being rapidly developed and is now raising and marketing, since the close of the fiscal year, its first crop.

The capital stock of the company remains unchanged at the end of the fiscal year, amounting in the aggregate to $50,000,000 divided between first preferred, second preferred and common, with an additional 50 millions authorized but not issued. The changes in the funded debt during the year make a net increase of $17,725,500 issued for improvements and new equipment expenditure and the purchase of securities of the newly acquired companies mentioned above. Additional equipment notes aggregating $3,064,579 were issued during the year and $263,408 of equipment notes were paid.

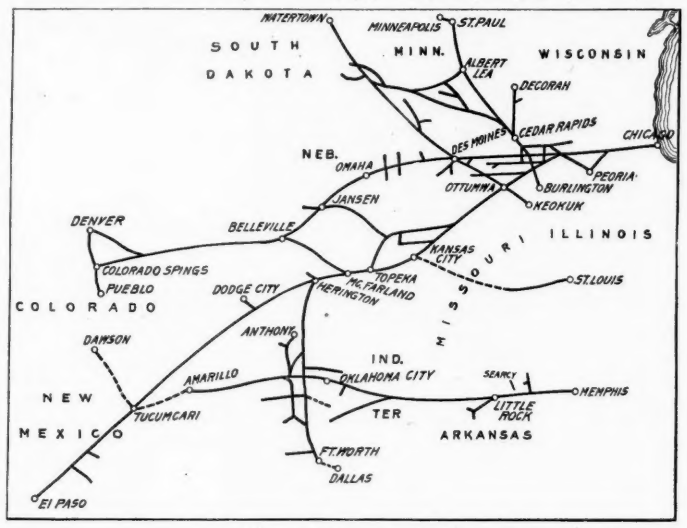
Statistics of operation follow.

	1903	1902
Average mileage worked	3,675	3,252
Freight earnings	$17,398,876	$15,606,243
Passenger earnings.	4,885,163	4,253,758
Gross earnings.	24,289,510	21,620,882
Gross per mile	6,609	6,648
Main. of way and structures.	3,438,839	2,978,847
Main. of equipment	2,613,160	2,212,306
Total operating expenses ...	15,875,977	13,472,471
Expenses per mile	4,320	4,142
Net earnings	8,413,534	8,148,412
Net earnings per mile.....	2,289	2,505
Interest and charges	7,682,120	6,068,094
Surplus applic. to div.....	1,474,717	2,277,479
Surplus carried forward	634,975	1,472,197

Rock Island Company.

The first annual report of the Rock Island Company is so largely taken up with publication of the certificate of incorporation, lists of officers, and the affairs of the holding company, that there is little room for extended comment on the working of the complicated system of control by which the Chicago, Rock Island & Pacific *Railroad* owns and operates the Chicago, Rock Island & Pacific *Railway*, the company well-known by everybody for the past half century, while the Rock Island Company, as a holding corporation, owns the entire stock of the Chicago, Rock Island & Pacific *Railroad*. Not to take up in detail a criticism of this elaborate system of finance, it has the effect, whether or not it was so intended, of thoroughly confusing real values with paper values. This scheme was a product of the spirit of 1901; and there is some little satisfaction in observing that it would not be imitated at the present time by any company which desired to market its securities. It is sufficient to say that the present report effectually prevents operating comparisons with previous years.

The average mileage worked during the year by the Rock Island Company was 6,978, as against 3,883, reported by the Chicago, Rock Island & Pacific *Railway* in its last statement. Of the increases, 1,670 miles were added to the C., R. I. & P. proper by lease of the Burlington, Cedar Rapids & Northern and the Rock Island & Peoria, and by the opening of 166 miles of new line, all in Oklahoma, and mostly under the charter of the Enid & Anadarko. Other properties, comprising additional Rock Island Company mileage, but not included in the C., R. I. & P., are the Choctaw, Oklahoma & Gulf, 1,081 miles; the Chicago, Rock Island & Texas, 147 miles; the Chicago, Rock Island & Mexico, 91 miles; the Chicago, Rock Island & El Paso, 111 miles, and the Choctaw, Oklahoma & Texas, 113 miles. Railroads now



Chicago, Rock Island & Pacific.

under construction amount to 595 miles additional, under several charters.

On May 12, 1903, a circular was issued by J. P. Morgan & Co., offering to purchase all or not less than 225,000 shares of the common stock of the St. Louis & San Francisco in behalf of the Chicago, Rock Island & Pacific *Railroad* at $60 per share in C., R. I. & P. *Railroad* 5 per cent. gold bonds and $60 per share in common stock of the Rock Island Company. Up to August 13, last, 282,940 of the 290,000 shares had been deposited in acceptance of the offer, yet the two reports at hand, one of the Rock Island Company and one of the Chicago, Rock Island & Pacific *Railway*, are absolutely innocent of the slightest reference to this transaction, which would, to the layman, seem deserving of a footnote, at least. The casual reader, unfamiliar with higher finance, might easily be so ignorant as to surmise that a report issued by a holding company which overlooked a $28,000,000 purchase might be incompiete in other little details.

The change in the period reviewed from a fiscal year ending March 31 to a year ending June 30 adds to the present difficulty of making comparisons, although the change will be helpful in subsequent years because of the uniformity it introduces with the majority of railroads.

The separate report of the C., R. I & P. *Railway* gives traffic returns for a 15-month period and also presents a few figures for the year ending June 30. Gross earnings are not included in the latter, except per mile of road worked, but this figure, which is $6,573, multiplied by the average mileage, 5,500, gives $36,151,060 as the gross earnings, against $28,385,846 for the year ending March 31, 1902. Operating expenses, figured in the same way, seem to have been $22,453,475 for the June 30, 1903, year, as against $17,333,104 for the March 31, 1902, year, and net earnings, $13,697,585, as against $10,131,121. This is a very imperfect comparison for the reasons already mentioned. The following table of returns per mile shows more, although the difference in period cannot be taken into account. The figures for 1902 were obtained by dividing totals given by average mileage worked during the year.

Per mile of road.	1903. Year ending June 30.	1902. Year ending. March 31.
Average mileage worked.....	5,500	3,883
Freight earnings	$4,517	$4,909
Pass., mail and express.....	2,041	2,068
Gross earnings	6,573	7,570
Operating expenses, incl. taxes.....	4,280	4,701
Net earnings	2,490	2,609
Total income	2,821	2,853
Total charges, incl. rentals.....	1,325	994
Surplus applicable to dividends....	1,496	1,859

In view of the added mileage in relatively thin traffic territory, the showing is good, and the loss in density of business is less than might have been expected. The 1902 report, reviewed last year, was noteworthy for the great increase in passenger business, amounting to over 25 per cent. from the year previous, and for a large

growth in net earnings on the system as it was then worked, in spite of poor crops. No hint as to comparative conditions this year can be gleaned from the reports at hand, although it is a matter of common information that the corn crop, which suffered heavily in 1902, was much better in 1903.

The income account of the Rock Island Company is as follows:

The Rock Island Co.—	
Income from div. on stocks owned	$2,166,000
Other income	8,290
Expenses and taxes	216,299
Less dividends paid	1,454,856
Surplus	503,135
Operated lines and auxiliary companies—	
Gross earnings from transportation	44,376,620
Operating expenses	28,303,316
Net earnings	16,073,303
Rentals and taxes	2,359,844
Interest, C., R. I. & P. Railroad	1,853,553
Interest Rock Island system, operated lines	6,056,186
Other income	1,690,872
Div. to stockholders, Rock Island Co.	2,166,000
Dividends to the public	1,134,190
Less paid from stockholders improvm't loan acct.	249,989
Surplus	4,444,391
Combined surplus	4,947,527

From this combined surplus, $1,104,544 was spent on betterments.

NEW PUBLICATIONS.

Machine Design. Part I. Fastenings. By William Ledyard Cathcart, Adjunct Professor of Mechanical Engineering in Columbia University. New York: D. Van Nostrand Company, 1903. Cloth, $3 net.

The subject of Part I would indicate that Mr. Cathcart has set out to give a pretty thorough treatment of machine design, and several volumes, of the size of the first, will be required for proportionate treatment of the other parts of the general subject. In his preface the author states that three factors are essential to a satisfactory solution of machine design problems, namely, theoretical analysis, precedent, and the ripened judgment of the designer. Scientific analysis and the records of practice are both essential to success in the design of machine members, but neither alone is trustworthy. The former cannot fully provide for overloads, rough handling and slight accidents, while the latter give proportions only for specific cases from actual service. Empirical formulæ founded on practical data may give wrong results if the inherent limitations of the formulæ are exceeded.

There are five chapters in the volume, with the following headings: Shrinkage and Pressure Joints; Screw Fastenings; Riveted Joints: Theory and Formulæ; Riveted Joints: Tests and Data from Practice; Keyed Joints: Pin Joints. American practice only is presented. Full theoretical treatment is given in every case, and practical data are supplemented with numerous tables, there being altogether 77 in the book. Chapter I, on shrinkage and pressure joints, has an interesting and instructive section on gun construction in which is described in detail the method of making the 16-in. breech-loading rifle completed in 1900 by the Ordnance Department U. S. A. at Watervliet Arsenal. This is said to be not only the most powerful gun yet built, but the largest construction ever assembled by shrinkage. The data from practice on riveted joints in Chapter IV. were obtained from the Bureau of Steam Engineering of the Navy and from a number of the leading manufacturing plants of the country, including ship builders, bridge and locomotive works. These tables and other data are complete and valuable. The book has 291 pages and a complete index. The printing and illustrations are good, and the latter are placed conveniently to their text references.

The Daughter of a Magnate. By Frank H. Spearman, illustrations by T. R. Gruger. 5 in. x 7½ in., pp. 273. Cloth cover. Published by Chas. Scribner's Sons, New York.

Mr. Spearman has written a thoroughly good novel based on sound railroading. The incidents are well told and dramatic; the characters are of flesh and blood and the railroad experiences have the charm of originality and the ring of truth. They might well have happened, and while reading we feel that they are happening and that we are in the thick of it ourselves.

The keynote of the story is contained in the speech of Morris Blood, the division superintendent: "I shan't want to do that again in a thousand years. In the railroad life it always comes different, every time." One of the best descriptions is that of blasting a cliff into the hole made by a washout to save the time of transporting rock from up the line. Again the night run of 170 miles through a blizzard, the heroine and her lover tossed about the cab of a locomotive as they plow through a huddled herd of sheep and packed snow drifts.

Ab Glover, the construction engineer, tireless, ingenious, dogged, is the central character of the story. To him each turns in an emergency and his nerve and quick judgment find a way out. He is a not too highly idealized type of the ready, competent railroad officer.

The heroine, although drawn on rather conventional lines, is bright and attractive and the love story is pretty and well sustained. Railroad men will find the book accurate and plausible and will enjoy the mixture of their work and a compelling romance, and parts of it they will feel keenly as these words of Glover's: "And so a hundred times and in a hundred ways we gamble with death and laugh if we cheat it, and our poor reward is only sometimes to win where far better men have failed. So in this railroad life two men stand, as he and I have stood, luck or ill-luck, storm or fair weather, together."

Locomotive Breakdowns, Emergencies and Their Remedies. By George L. Fowler, M. E. New York: The Norman W. Henley Publishing Co., 1903. 12 mo., 250 pp. Cloth, $1.50.

The author well says that it is the man who has worked out the problem in advance that is the one ready to deal with an emergency. He has endeavored to cover in his book every possible accident or breakdown that is liable to occur, and by careful study of the remedies prescribed, the engineman, fireman or other railroad man may be prepared in advance to do effective work in any emergency. The book is in the form of a catechism, containing over 800 questions with their answers, and treats the subject in a systematic manner. The parts liable to breakdown or accident are taken up separately, a chapter being given to each. The language is simple and illustrations are given wherever needed to make the meaning clear. Accidents peculiar to compound locomotives are treated in a separate chapter, and there is also a chapter on miscellaneous accidents. Chapter 15 on tools and appliances for making engine repairs illustrates a number of handy devices for making repairs in the shop. The author's explanation for introducing these in a work on road emergencies is that they are valuable in enabling quick work to be done in the shop or roundhouse on what practically amounts to emergency repairs. The final chapter on Aid to the Injured gives a few simple directions for applying bandages, treating injuries and moving patients that should be helpful in alleviating suffering and possibly saving life. The catechism form of the work makes it convenient for use in examinations of enginemen and firemen.

Steel Mill Buildings. By Milo S. Ketchum, Assistant Professor of Civil Engineering, University of Illinois. New York: The Engineering News Publishing Co., 1903. Cloth, 301 pages. Price $4.

The primary object in writing this book was apparently to supply the need of an intermediate text book which would supplement the elementary books on stresses on the one hand and the more elaborate treatises on bridge design on the other. It covers a broader field than its title indicates as it is in reality a treatise on framed structures of all kinds with particular stress laid on the design of large open buildings with steel frame work. The problems in elementary stresses are treated algebraically and graphically and are developed one from the other in logical order. Some original graphical solutions of the stresses in transverse bents, portals and two-hinged arches are given which are simple and easily understood. Another diagram which is new and which will save much time by its use, is one for finding the stress in eye-bars, due to their own weight. Much of the matter in the book has been obtained by the author through his practical experience in connection with the design and erection of such structures as are dealt with, and the presentation in its present form has been made after a four years' experience in the class room. A complete set of general specifications for steel buildings is given in the last chapter in which are embodied most of the principles of design and construction laid down in the preceding pages. The illustrations are numerous and the drawings well executed.

Roof Framing Made Easy. By Owen B. Maginnis. New York: The Industrial Publication Co., 1903. Cloth, 164 pages.

This is the second edition of Mr. Maginnis's practical work on roofs and roof framing, and it has been thoroughly revised and somewhat enlarged. It is written in concise and intelligible language with no attempt to explain the theory of roof trusses or the reasons for taking certain steps in laying out and developing the sizes and positions of the various members of the framing. The book is intended for practical men and as a working guide it covers the subject in a complete manner. Almost every conceivable form and shape of wood framed roof is explained in more or less detail with the aid of nearly 100 engravings which are placed conveniently to the accompanying text.

Mechanical World Pocket Diary and Year Book for 1904. Manchester (England): Emmott & Company, Ltd. Cloth, 6d. net.

This is the seventeenth annual issue of this little book. New matter has been added, particular attention having been given to the section on Valve Diagrams which was rewritten and amplified. Other added matter includes tables of calculated results for the most generally-used moduli of sections, weight of copper bars, new tables of stresses on bolts, steam and gas-pipe fittings, and bevel and spur gear formulæ. There are 247 pages of reference matter and the remainder of the book is arranged for a diary for 1904. It is 4 in. x 6 in. and makes a useful little reference work.

The government employees of Germany have a society for educational improvement in the various political sciences, which is under the presidency of the Chancellor of the Empire, and has many eminent scholars, public officers and economists in its ranks. This winter there will be a series of "conversational lectures" before it, including many on railroad matters, by leading officers in the Ministry of Public Works. Dr. A. von der Leyen, who has published a book on the railroads of this country, will lecture on railroad economics and railroad rates. Among the more general subjects may be mentioned manufacturing law and the labor question, commercial geography, and statistics.

Train Accidents in the United States in October.[1]

bc, 1st, 4 a.m., St. Louis & San Francisco, Thayer, Mo., butting collision between a northbound passenger train and a southbound freight, wrecking both engines and four cars. One engineman and one fireman were killed, and two other persons were injured.

bc, 1st, Northwestern Elevated, Chicago, Ill., Sedgwick Street Station, butting collision of electric cars on a track which, it appears, is used at certain times of the day for trains in opposite directions. Four employees were injured.

bc, 1st, Tennessee Central, Ozone, Tenn., butting collision between a freight train and a work train; one man killed and 12 injured.

†bc, 2d, Southern Pacific, Be-o-wa-we, Nev., butting collision between the eastbound Atlantic express train and a westbound freight, badly damaging three locomotives and wrecking two passenger cars. One passenger was killed and six were injured. It is said that the freight had insufficient time to reach the station before the passenger was due to leave and that the engineman proceeded, nevertheless; the conductor discovered this error and applied the air-brakes; this caused the train to break in two; the fireman went forward to flag the passenger train, but it is said that the engineman of the passenger did not see the flag.

*rc, 3d, Pere Marquette, Breedsville, Mich., a freight train which was unexpectedly stopped by the rupture of an air hose was run into at the rear by a following freight, and the engine was overturned. The caboose and a dozen cars were wrecked and the wreck took fire and was mostly burnt up. The engineman was killed.

bc, 3d, Southern Pacific, Alameda, Cal., butting collision between a switching engine and a freight train. One employee and one of two women riding on one of the engines was injured.

xc, 3d, 4 a.m., Southern Pacific, Chatsworth Park, Cal., a work train collided with some cars standing on the main track. Three employees were killed and 17 injured.

bc, 5th, San Francisco & North Western, Fortuna, Cal., butting collision of two freight trains, each drawn by an engine running backwards. One fireman and one brakeman were killed and two other trainmen were injured. It is said that the collision was due to conflicting telegraphic orders.

unx, 5th, Southern Pacific, Lang, Cal., a freight train was derailed and a tramp was killed.

o, 5th, 10.30 p.m., Northern Pacific, Birdseye, Mont., the locomotive of a freight train was damaged by an explosion of dynamite, which had been maliciously placed on the track.

bc, 6th, Southern Railway, Goldsboro, N. C., butting collision of passenger trains badly damaging both engines. One engineman was injured.

bc, 6th, Kansas City Southern, Siloam Springs, Ark., butting collision between an empty engine and a freight train drawn by two engines, wrecking the three locomotives and several cars. Two enginemen and two firemen were killed.

unx, 6th, Chicago, Cincinnati & Louisville, Richmond, Ind., a passenger train was derailed and the engine was overturned. The engineman was fatally injured.

*bc, 7th, Illinois Central, Calvert City, Ky., butting collision of freight trains on a trestle bridge; nine cars, with most of the bridge, fell to the ravine below, and the wreck took fire and was burnt up. One engineman and one fireman were killed.

xc, 9th, 10 p.m., Lake Shore & Michigan Southern, West Seneca, N. Y., an eastbound passenger train ran over a misplaced switch and into the rear of a freight train standing on a side track. The freight conductor was killed and the passenger fireman was injured.

dr, 9th, Missouri, Kansas & Texas, Westville, Texas, a freight train was derailed by a broken rail and 10 cars were wrecked. A man stealing a ride was killed.

unf, 9th, Erie road, Athenia, N. J., a passenger train was derailed at a washout and one trainman and three passengers were injured.

bc, 11th, Baltimore & Ohio, Glencoe, Ohio, butting collision between a westbound freight train and an eastbound light engine, wrecking three engines; three trainmen slightly injured.

bc, 11th, 10 p.m., Chicago, Peoria & St. Louis, Grafton, Ill., butting collision between passenger train No. 79 and a freight train, wrecking both engines and three freight cars. The engineman and fireman of the freight jumped off and were fatally injured.

xc, 12th, 5 a.m., New Albany, Ind., a locomotive of the Baltimore & Ohio ran into a freight train of the Chicago, Indianapolis & Louisville at the crossing of the two roads, damaging the engine and wrecking two cars.

xc, 12th, Kansas City, Mo., a freight train of the Missouri Pacific ran into a freight of the St. Louis & San Francisco at the crossing of the two roads and one engine and several cars were damaged. Three trainmen were killed and three injured.

unf, 12th, 11 p.m., Gulf & Ship Island, Laurel, Miss., a freight train broke through a trestle which had been weakened by fire, and the engine and 11 cars were wrecked and burnt up. The engineman was severely burned.

unx, 12th, Atlanta, Knoxville & Northern, Farner, Ga., the engine of a freight train was derailed on a trestle bridge and the fireman, fearing that the engine would fall to the ravine below, jumped off and was badly injured.

rc, 13th, 10 p.m., Brunswick & Birmingham, Hofferman, Ga., a passenger train collided with the rear of a preceding freight which, in ascending a grade, "failed to make good," and ran back uncontrolled down grade into the passenger train. A brakeman and a fireman were killed and two other trainmen injured.

xc, 13th, 1 a.m., Reed City, Mich., a freight train of

[1]Accidents in which injuries are few or slight and the money loss is apparently small will as a rule be omitted from this list. The official accident record published by the Interstate Commerce Commission quarterly is regularly reprinted in the *Railroad Gazette*. The classification of the accidents in the present list is indicated by the use of the following

ABBREVIATIONS.

rc	Rear collisions.
bc	Butting collisions.
xc	Miscellaneous collisions.
dr	Derailments; defect of roadway.
eq	Derailments; defect of equipment.
dn	Derailments; negligence in operating.
unf	Derailments; unforeseen obstruction.
unx	Derailments; unexplained.
o	Miscellaneous accidents.

An asterisk at the beginning of a paragraph indicates a wreck wholly or partly destroyed by fire; a dagger indicates an accident causing the death of one or more passengers.

the Pere Marquette ran into a passenger train of the Grand Rapids & Indiana, at the crossing of the two roads, overturning the mail car and tender. There was a dense fog at the time.

xc, 13th, Philadelphia, Baltimore & Washington, near the Navy Yard tunnel, Washington, D. C., collision between a work train and a locomotive of the Richmond, Fredericksburg & Potomac, wrecking one car. One employee was killed and several others injured.

dn, 13th, Norfolk & Western, Elizabeth City, N. C., a passenger train was derailed at a misplaced switch and the engine was overturned. The engineman was fatally injured.

bc, 14th, Hawkinsville & Florida Southern, Worth, Ga., butting collision between a freight train and a work train; one conductor and one engineman killed and seven other employees injured. It is said that the collision was due to conflicting telegraphic orders.

xc, 14th, 4 a.m., Pennsylvania Lines, Indianapolis, Ind., collision between a freight train and an empty engine, badly damaging both engines. The fireman was fatally injured.

unf, 14th, Southern Railway, Gastonburg, Ala., a work train was derailed by running over a hand car, and the engine was ditched. Two trainmen were injured.

unx, 14th, Baltimore & Ohio, Newburg, W. Va., a light engine was derailed and fell down a bank. The fireman was killed.

dr, 15th, Atchison, Topeka & Santa Fe, Kansas City, Mo., passenger train No. 8 was derailed at a switch, and a switchman walking along the track was killed. Two mail clerks were injured.

unx, 15th, Missouri Pacific, Langley, Kan., a freight train was derailed and 11 cars were wrecked. Four tramps were killed.

dn, 16th, Southern Pacific, Orange, Texas, a special train, consisting of an engine and five cars, carrying officers of the road, was derailed at the derailing switch approaching the crossing of the Orange & North Western. According to a local paper "this is the first time since the interlocking device was put in at this place that an opportunity has been presented to test its efficiency; and it worked like a charm." Not every charm is thus heightened by the presence of the officers of the road.

unx, 17th, Southern California, High Grove, Cal., a car in a freight train was derailed on a sharp curve, and, with seven other cars, fell down a bank. A brakeman was killed and the conductor was injured.

17th, 6 a.m., Pennsylvania road, Lambertville, N. J., a work train ran into the rear of a preceding work train, wrecking a passenger car filled with Italian and negro laborers. Seventeen of these men were killed and 34 injured. There was a dense fog at the time. The foremost train had been at rest 17 minutes, and a flagman was posted some distance back; but there is conflicting evidence as to how far back. Both trains were engaged in repairing the extensive damage which had been done by a flood in the Delaware River.

xc, 17th, Southern Pacific, Tamarack, Cal., a freight train ran over a misplaced switch and collided with some boarding cars standing on a side track, injuring five employees.

rc, 18th, 8 p.m., Chicago, Rock Island & Pacific, Fairbury, Neb., a freight train standing in the yard was run into by a following freight and five trainmen were injured.

dr, 18th, 11 p.m., Philadelphia, Baltimore & Washington, Washington, D. C., a passenger train of the Chesapeake & Ohio broke through the draw in the bridge over the Potomac River and the tender of the engine and an empty baggage car fell into the stream. A bridge tender is supposed to have been drowned.

unf, 18th, Southern Railway, Dallas, Ga., a freight train was derailed at a point where the rails had been maliciously loosened, and the engine and 12 cars fell through a bridge into a creek.

bc, 19th, Southern Railway, Keysville, Va., butting collision of passenger trains, wrecking both engines and damaging several cars. One engineman, one fireman, one brakeman and one postal clerk were killed and three other trainmen and one passenger were injured.

unf, 20th, Seaboard Air Line, Silver Springs Junction, Fla., a freight train was derailed at a washout and the engine and nine cars were wrecked. A tramp was fatally injured.

unx, 20th, Norfolk & Western, Lowry, Va., a freight train was derailed and seven cars of coal were wrecked. A man stealing a ride was killed.

o, 21st, West Virginia Central & Pittsburg, Elkins, W. Va., a yard engine was wrecked by the explosion of its boiler and three employees and a woman were killed. The cause of the explosion is reported as unknown; supposed to be low water.

*o, 23d, 1 a.m., International & Great Northern, Austin, Texas, the mail car in a passenger train was set afire by the explosion of a gas reservoir beneath the floor. The conductor and engineman were severely burned while putting out the fire.

rc, 24th, Southern Pacific, Edison, Cal., a light engine descending a steep grade ran into the rear of three other light engines ahead of it; one fireman was injured.

*rc, 24th, 3 a.m., Alabama Great Southern, Tuskaloosa, Ala., rear collision of freight trains wrecking several cars. The wreck took fire and eight loaded cars were burnt up. Three trainmen were injured.

bc, 24th, Western & Atlantic, Bolton, Ga., butting collision of freight trains, badly damaging both engines and several cars. One fireman was killed and several trainmen were injured.

bc, 24th, Baltimore & Ohio, Glovers Gap, W. Va., butting collision of freight trains, one of which was standing at the station. Both engines were wrecked and 25 cars badly damaged. It is said that the engineman of the moving train was asleep.

bc, 24th, Norfolk & Western, North Fork, W. Va., butting collision of freight trains, wrecking both engines and 15 cars. One engineman was injured. It is said that the collision was due to one of the trains becoming uncontrollable on a steep grade.

xc, 24th, 1 a.m., New York, New Haven & Hartford, Bay Chester, N. Y., a freight train descending a grade broke in two and the rear portion afterward ran into the forward one. The collision exploded some gunpowder in one of the cars and three cars were blown to splinters.

unx, 24th, 1 a.m., Louisville & Nashville, Woodbine, Ky., passenger train No. 26 was derailed and most of the cars were overturned. Several passengers were injured.

*xc, 25th, Western Maryland, Chambersburg, Pa., a freight train broke in two and the rear portion afterward ran into the forward one, derailing four cars, one of which fell into a lake. One car containing powder blew up and the wreck was destroyed by fire.

rc, 26th, Delaware, Lackawanna & Western, Orange, N. J., an eastbound passenger train just starting from the station was run into at the rear by a following passenger train and the rear car of the foremost train was badly damaged. Twenty passengers were injured. The point where the collision occurred is near the middle of a short block section equipped with automatic block signals. The engineman of the second train asserts that the signal indicated clear, and it is said that he has a number of witnesses to corroborate his statement.

bc, 26th, Kansas & Arkansas Valley, Ashby, Ind. T., butting collision between a gravel train and a freight; due, it is said, to failure of the conductor of the gravel train to protect the train by flag. One fireman was killed and one other trainman injured.

unf, 26th, 3 a.m., Baltimore & Ohio, Sykesville, Md., a freight train was derailed by a car door lying on the track, and the engine fell down a bank. The engineman was killed and two other trainmen were injured. The door had been knocked off a car of a train running in the opposite direction in consequence of the failure of a coupler, allowing the slack of the train to violently close up.

o, 26th, Pennsylvania road, Rohrerstown, Pa., the locomotive of a freight train was wrecked by the explosion of its boiler; conductor, fireman and one brakeman killed, engineman fatally injured.

rc, 27th, Denver & Rio Grande, Salida, Colo., a freight train became uncontrollable on a steep descending grade and ran into the rear of a preceding freight. Three trainmen were killed and one injured.

27th, Southern Pacific, Palisade, Nev., an eastbound passenger train collided with a work train and seven employees on the work train were killed and three passengers and two trainmen were injured.

dn, 28th, Southern Railway, Bessemer City, N. C., a freight train drawn by two engines was derailed at a point where the track was undergoing repairs; engineman, fireman and one tramp killed and two other trainmen injured. The track foreman says that stop signals displayed by him were not heeded, but, on the other hand, it is claimed that the signal was not properly displayed.

unf, 28th, Philadelphia, Baltimore & Washington, Philadelphia, Pa., a work train was derailed by running into a street car at a crossing; six men were injured.

†28th, 10 p.m., Atchison, Topeka & Santa Fe, Marceline, Mo., passenger train No. 2 was derailed at a switch, a brake rod of a sleeping car having dropped and caught on a switch rod. Three sleeping cars and a dining car were ditched. One passenger was killed and 20 were injured.

bc, 29th, Baltimore & Ohio, Nicolette, W. Va., butting collision of freight trains, one of which appears to have passed a stop signal displayed against it at a station. Two engines and ten cars were wrecked. One engineman and one fireman were killed and one brakeman was injured.

unf, 30th, 1 a.m., Atchison, Topeka & Santa Fe, Fowler, Colo., eastbound passenger train No. 6 was derailed near a bridge in consequence of the malicious removal of splice bars in the track. The engine and first two cars fell through the bridge. Thirteen passengers were injured. A span of the bridge 100 ft. long was wrecked.

unf, 30th, Southern Pacific, St. Martinsville, La., a freight train was derailed by running over a cow, and the engine and several cars were wrecked. The fireman was killed and the engineman injured.

eq, 31st, Philadelphia & Reading, Neshaminy Falls, Pa., an eastbound passenger train, running at high speed, was derailed by the breaking of a driving wheel axle. The loosened wheel in falling off struck and killed a track foreman, and injured three laborers.

†bc, 31st, 10 a.m., Cleveland, Cincinnati, Chicago & St. Louis, Indianapolis, Ind., (within yard limits) an eastbound special passenger train of 14 cars, all filled with passengers, collided with a switching freight train in the yard, making a very bad wreck. Sixteen passengers were killed or fatally injured, and more than 30 others were badly hurt. Most of the victims were in the foremost passenger car, which was next to the tender of the engine. The passenger train was running under a special order issued by the despatcher and under a general rule requiring all unscheduled trains to run under control within the yard limits. The yard train was moving toward the passenger train, so that the collision was butting. The engineman of the passenger train said after the disaster that he could have prevented or greatly mitigated the collision if the yard train had been *standing* at the point where he first saw it. Officers of the road have stated that the cause of the collision was the disregard of the under-control rule; but there was an order or notice of some kind sent to North Indianapolis intended to give notice to the yard train that the special was to be run; this notice was not delivered and the coroner's verdict lays the blame for the collision on the despatcher for not seeing that this notice was seasonably sent and delivered. This collision was reported in the *Railroad Gazette* of November 6, page 802, and November 13, page 814.

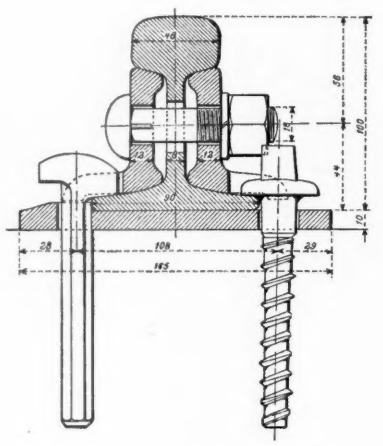


Fig. 1.—Rail Section and Fastenings.

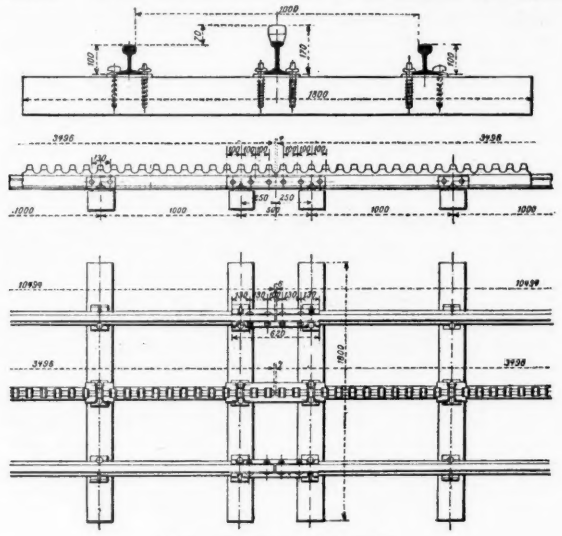
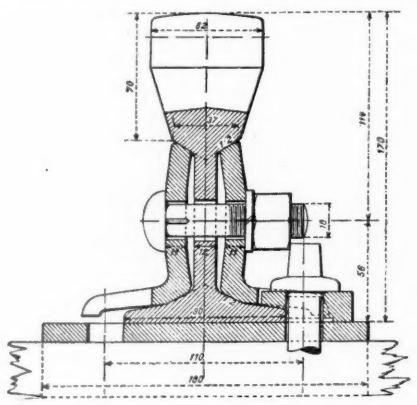


Fig. 2.—Rack Rail Track.

(Dimensions given in millimeters.)



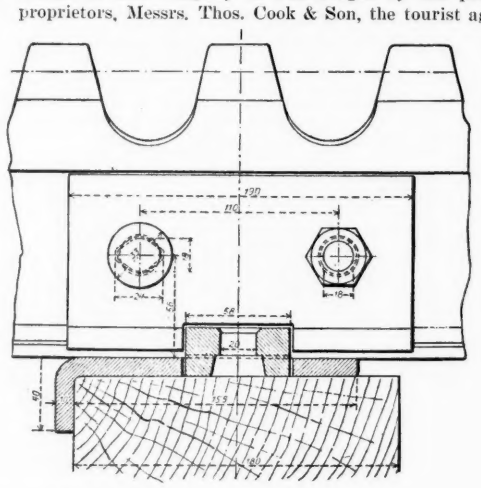


Fig. 3.—Rack Rail and Angle-Clip.

(Dimensions given in millimeters.)

Electric Railroad up Mt. Vesuvius.*

In 1879-1880 an inclined plane tramway was built up Mt. Vesuvius. It starts at the bottom of the cinder cone about 2,600 ft. above sea level and rising 1,273 ft., which is about one-third of the total height of the mountain, ends near the old crater, which is about a hundred yards from the present crater. The horizontal length of the plane is 2,362 ft., the average grade being 54 per cent., with 63 per cent. maximum and 39 per cent. minimum grades. This road was built by the Roman Bank and cost about $87,000, and being very successful was sold for $240,000 to a company formed to operate it. On the failure of this company it was bought by the present proprietors, Messrs. Thos. Cook & Son, the tourist agents of London, for $34,000. In order to bring passengers to the foot of the inclined plane an electric road is being built to connect with the Resina station of the Naples-Pompeii electric railroad. The new line, which is nearly completed, is meter gage and is to be worked by adhesion and rack rail. It is 4.6 miles long with 8 per cent. grades on the adhesion and 25 per cent. grades on the rack section. In the first section, adhesion alone is used and the road practically follows the surface of the ground with a grade of 5 per cent. In one or two places lava currents have necessitated shallow cuts 6 to 10 ft. deep. It may be remarked that in building on lava a deep cut is preferable to a shallow one. The lava always covers a layer of loose cinders which can be easily removed and the lava is then readily broken down. It is therefore desirable that the cut reach at least to the top of the cinder layer.

The second section from Centrale to Observatorium is laid with the rack rail and is 5,383 ft. long. It begins at

*Translated abstract from *Revue Generale des Chemins de Fer* for October, 1903.

the edge of the lava stream of 1872, and has several curves and cuts, of which latter some are over 30 ft. deep. The average grade is 20 per cent., with a maximum of 25 per cent., the total rise being 1,128 ft. The third section, 8,530 ft. long, is operated by adhesion, the maximum grade being 8 per cent.

The construction of the line has been divided into five sections, the work being let to four contractors. The stone work, both dry and mortared, is of lava. The mortar is made of a mixture of the clay from the cuttings with lime, and on account of its hydraulic properties is extremely durable. The same mortar is being used on the dry dock being built in Naples.

The masonry costs from $1.00 to $1.75 per cu. yd., according to the distance the stone has to be transported, the low price being due to the cheap labor available. The Italian laborers get from 30 to 40 cents a day, and masons from 50 to 60 cents a day. The cuttings are about 11,400 cu. yds. and the fills measure about 70,000 cu. yds. There are about 4,000 cu. yds. of masonry. Exclusive of the cost of the ground the construction of the road has cost about $60,000, or $13,000 a mile.

The material for all fills has been transported by the Italian laborers, who carry the rock and earth on their shoulders in round baskets, taking about 90 to 100 lbs. at each trip. The contractors would have preferred a more modern method, but had to give way before the prejudices of the men. However, satisfactory results have been obtained particularly in certain cuts where the material had to be carried 100 yds. or more with a considerable rise.

The rails, Fig. 1, are 4 in. high and weigh 40 lbs. per yard. These are 34 ft. 6 in. long, which is three times the length of the rack rails. The joints are made with angle fish plates, which are cut out to take the heads of the spikes and woodscrews so as to prevent the rails from creeping. Steel tie plates are used on the rack section and on curves. The ties are of oak, 5 ft. 11 in. long, from 6 to 7 in. wide and 5 to 5½ in. thick. They cost, delivered, about 40 cents apiece.

The rack rail, shown in Figs. 2 and 3, is of the Strub system, as used on the Jungfrau Ry., the Trieste-Opeina Ry., and the Monte Carlo rack railway. In order to overcome the tendency to longitudinal movement due to traction and braking, the rail is held to each tie by an angle clip, and rests on a plate which has a flange bearing on the vertical face of the tie as shown in Fig. 3. And further at distances varying from 100 to 300 yds. the ties are held by cement blocks.

The trains consist of a single motor car which is helped on the rack section by a rack locomotive. The cars, which are open, weigh empty about 18,500 lbs., and have four wheels, the wheel base being 6 ft. 10 in. They carry 30 passengers, although there are seats for but 24.

There are two systems of brakes. The first is an ordinary hand-brake operating shoes on both sides of all four wheels. When fully loaded this brake is powerful enough to permit a speed of seven miles per hour coming down an 8 per cent. grade, and to stop on this grade in 30 ft. The second brake is electro-magnetic and operates directly on the rails. The magnets are normally carried by springs about an inch above the rail. On the down grade the motors are run as dynamos, the current being sent through the magnets, which exert a pull on the rail of about 8,800 lbs., which, allowing an average coefficient of friction of 0.2, gives 176 lbs. brake power. This together with the braking effect of the motors running as dynamos is sufficient to stop the car on an 8 per cent. grade in about 60 ft., or double the distance in which the other brakes stop the car.

The electric rack locomotive is shown in Fig. 4. It weighs about 23,000 lbs. and can take 24,000 lbs. up a 25 per cent. grade at from 4½ to 5 miles per hour. The power is furnished by two shunt wound motors of 80 h.p. each running at 650 to 700 r.p.m. and driving the pinion of the rack-rail by double reduction gearing as shown. The locomotive is carried on two axles, on one of which is a gear wheel with band brake. On the other axle and at the end opposite to this axle are arranged jaws to keep the pinions from leaving the rack. There are three systems of brakes: Independent band brakes on each pinion, each capable of holding the locomotive, for emergency brakes; a double band brake acting on each of the shafts of the motors, an automatic brake which operates the motor brakes and cuts off the current if the maximum allowable speed is exceeded. When coming down the 25 per cent. grades the shunt wound motors are run as dynamos and force current back into the accumulator batteries of the power house.

Current is furnished at a tension of 550 volts. The maximum demand for power occurs when a car is on each of the adhesion sections with another on the rack. This requires 244 h.p., and as the inclined plane take 60 h.p. the maximum is 304 h.p. at the power house, which requires a current of 416 amperes. This only occurs under exceptional circumstances and the station is therefore equipped with storage batteries. The two dynamos which supply 137 amperes, work in parallel with 300 Tudor accumulators having a capacity of 256 ampere hours for one hour; this is practically sufficient to take care of the maximum requirement. The dynamos are belted to two 100 h.p. gas engines which are supplied from two Dawson gas generators, of which only one is run, the other being held in reserve.

The three pumps which supply water for cooling the cylinders and cleaning the gas are belted from a 4½ h.p. motor. This motor also drives an air pump which furnishes compressed air for starting the engines. About 132 gallons of water are used per hour, which with an average of five hours a day represents about 260,000 gallons a year. The cost of coal is $10 a ton, and for an output of 180,000 h.p. hours it amounts to $1,260 a year.

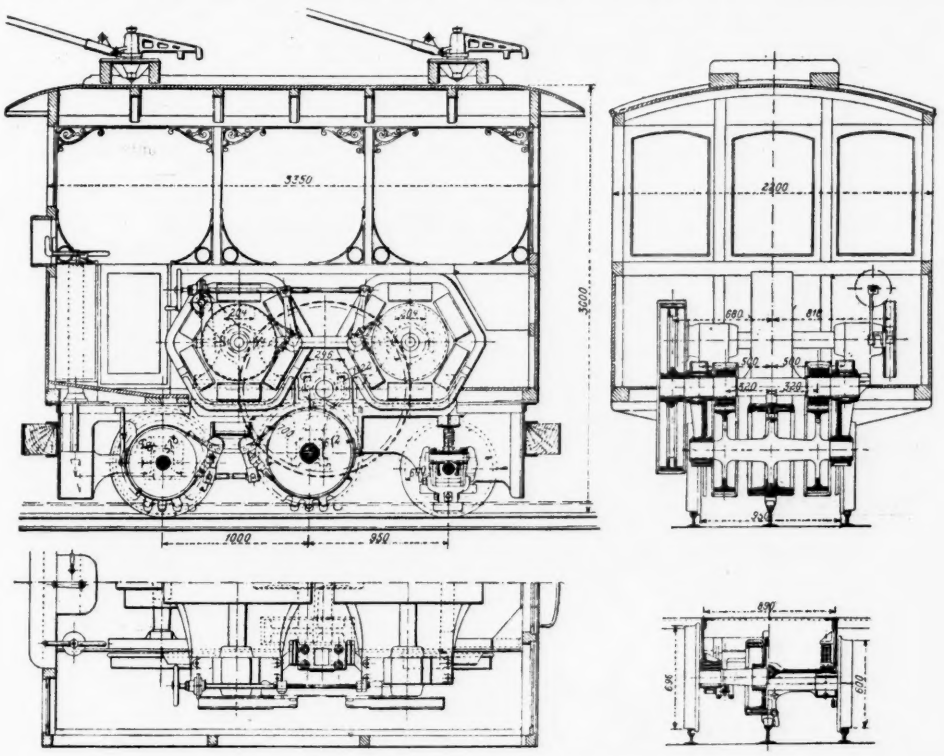


Fig. 4.—Rack Rail Electric Locomotive.

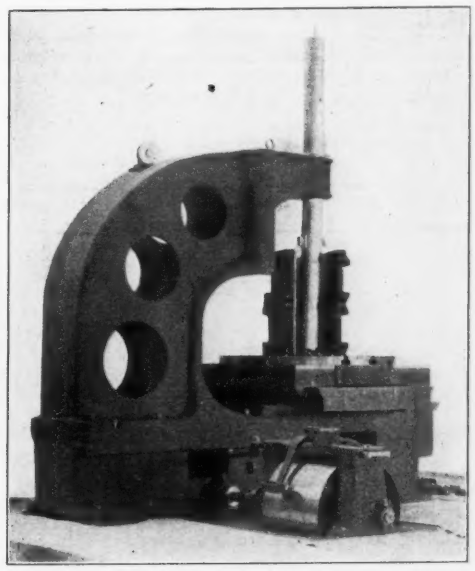
A 30-in. Draw-Stroke Slotter.

The two engravings show an unusually heavy design of machine for internal slotting, acting on the draw cut principle, for locomotive and railroad shops. While this machine was designed primarily for machining steel locomotive driving boxes, it is adapted to a great variety of other work in slotting forgings or castings having a great amount of metal to remove, or in machining long deep holes where the regular slotter cannot reach. It will do shaper work on the ends of long pieces of irregular shape where it is difficult to chuck them readily in a planer. In addition the machine may also be used as a keyseater.

The working table, which is 38½ in. in diameter with a 20-in. hole, is placed 32 in. above the floor level so as to be convenient for the operator. Full automatic feeds in all directions are provided and all feeds are readily engaged by the operator when standing in front of the machine, the hand feeds being operated from the same position. The length of feed is adjusted at the right side of the machine.

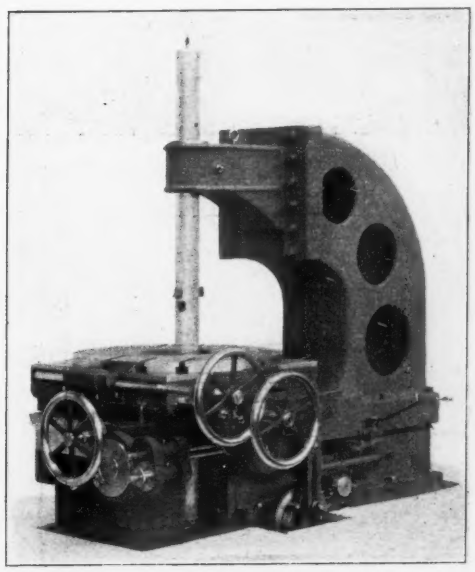
The ram is driven with a rack and pinion through a very heavy train of gearing, and is counterbalanced. The reverse is accomplished by means of shifting belts, which for heavy duty have been found superior to a friction clutch device. The belts are wide and shift freely.

The bar carrying the cutting tool can be any shape or size up to and including 4½ in. in diameter. A bar in the machine can be very readily replaced by one of another size, by the substitution of suitable bushings. The support of the bar is very rigid, as it is fixed at one end by clamping in a long bearing in the driving ram. It is held by a bushing in the lower table directly below the work, and also in a bushing in the upper arm directly above the work. Supported in this manner, with a stiff upper arm, the bar is extremely rigid. The tool relief in the return stroke is secured by means of a clapper box in the cutter-bar. In the largest size cutter-bar the working tool is made from 2 in. x 1 in. stock.



30-in. Draw Stroke Slotter.

Some tests made with one of these machines give some idea of their power and capacity. A steel driving box was used with a circle to be machined, 11¾ in. in diameter. The amount of stock removed was ⅜ in. full and the length of cut was 11½ in. The time required to take a roughing and finishing cut over all the surfaces, including the corners, was 28 minutes. The roughing cut used was ⅜ in. deep and ¼ in. feed, and the machine made 15 cutting strokes per minute. At this rate 240 lbs. of metal would be removed per hour. In a second test on the same driving box using a cut ¾ in. deep with ⅛ in. feed and a stroke of 11½ in., 22 in. of the circumference was machined in 15 minutes. This was at the rate of 725 cu. in., or 242 lbs. of metal removed per hour.



30-in. Draw Stroke Slotter.

One of these machines forms a part of the new equipment of the Locomotive & Machine Co.'s shops at Montreal, Que. They are made by Baker Bros., Toledo, Ohio.

Foreign Railroad Notes.

In Belgium the railroad authorities are endeavoring to make sure that signals be observed. Recent occurrences have indicated that the enginemen have "used their judgment" when the rules require them to observe only the signals. There was an accident recently, and at the investigation all the trainmen swore that the signals were set for line clear, while all the station men swore that they were not.

For several months negotiations have been pending between Brand, Brandau & Co., contractors for the Simplon Tunnel, and the Swiss government, relative to allowances for work on the tunnel not contemplated in the original contract. The latter called for 54,500,000 francs for a single track tunnel and a parallel gallery utilized in its construction, afterwards to be enlarged and devel-

oped for a second track, the first to be ready for traffic by May 1, 1904. The second tunnel, when required, was to be completed for 15,000,000 francs. The work has been delayed chiefly by a stream of water tapped in the south approach, for which an outlet had to be constructed some miles in length, and partly for other reasons, and constructions in excess of those originally prescribed have been required. The result of the negotiations is that the time for completing the first tunnel has been extended one year, that an additional allowance of 3,971,650 francs will be made for it, and 19,500,000 against 15,000,000 for the second tunnel, which must be finished within four years from the time it is ordered, which, to hold the present contractors, must be within two years after the completion of the first tunnel. This will make the cost of the double track tunnel $15,122,000.

The railroad which the Russian government has built from Merv, on the Asiatic Midland, southward up the valley of the Murghab to the border of Afghanistan at Kushk, 195 miles, is not a brilliant commercial success. The stations are 34 miles apart on the average, and in 1900 the whole traffic amounted to 1,782 passengers and 4,783 tons of freight, which seems a very moderate amount for the Russian fortress at Kushk, which the railroad was built to supply, of course, with reference to its becoming a depot of supply for large operations on or beyond the border. It is on the road to India (also on the road *from* India).

Progress of Work on the Mississippi River Bridge at Thebes.

The accompanying photographs give a good idea of the progress of the work on the new Mississippi River bridge at Thebes, Ill. The substructure is expected to be finished by the early part of the summer of 1904 and the superstructure by the spring of 1906. This bridge was described in detail in the *Railroad Gazette*, Jan. 6, 1902,

Fig. 1—Concrete Arches in East Approach.

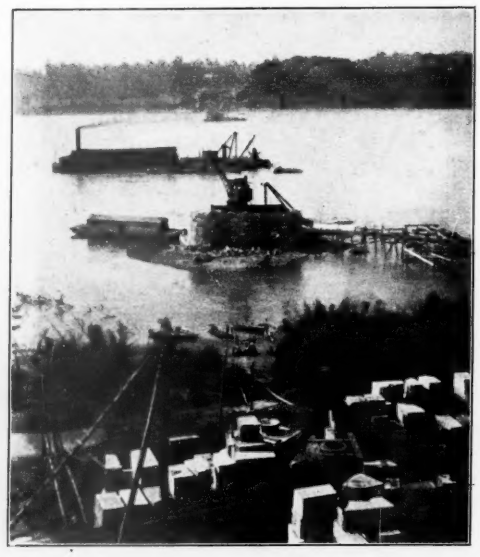


Fig. 2—Looking West from Top of East Approaches.

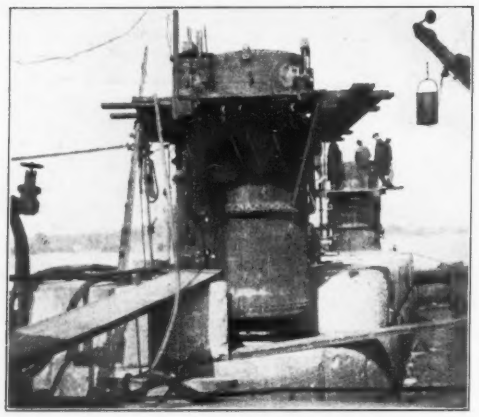


Fig. 3—Caisson and Air Locks Used in Sinking Pier No. 3.

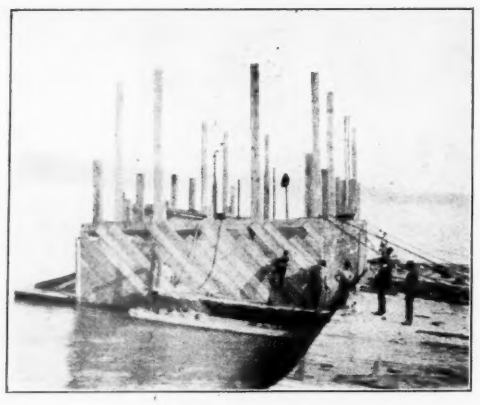


Fig. 4—Building Caisson for Pier No. 4.

but in order to add to the interest of the photographs, the following brief description is given.

The bridge is to be used by the Illinois Central and Chicago & Eastern Illinois on the east and by the Missouri Pacific and the St. Louis Southwestern on the west. The east approach consists of five concrete arches of 65 ft. clear span each. These arches are now finished with the exception of the parapet walls, as shown by Fig. 1. The west approach will consist of five 65 ft. concrete arches and one 100 ft. concrete arch. The foundations for these arches are now being built. The bridge proper consists of five steel spans resting on six piers. Commencing from the east, the spans are respectively 518 ft. 6 in.; 521 ft. 2 in.; 671 ft., 521 ft. 2 in., and 518 ft. 6 in. long. Pier 1 is completed. The foundation of pier 2 is finished and the masonry is being laid, as shown by Fig. 2. The pneumatic caisson of pier 3 is being sunk as shown by Fig. 3, and the caisson for pier 4 is being built near the east shore, as shown by Fig. 4. The foundation for pier 5 is finished and the masonry is being built. Pier 6 is being founded by open excavation, as there is solid rock close to the river bottom.

The approaches contain about 45,000 cu. yds. of concrete. The amount of excavation approximated 320,000 cu. yds. on the Illinois side and 300,000 cu. yds. on the Missouri side.

The bridge was designed by Messrs. Alfred Noble and Ralph Modjeski, Chicago, and is being built under their direction.

Bridges for Electric Railroads.*

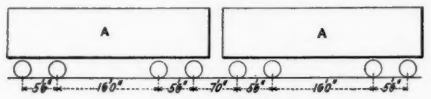
The interurban electric railroad is a development from urban methods of travel. The earlier lines and many of those now being built follow the highway, and use the highway bridges, reinforcing them where necessary, and in many cases, rebuilding the entire highway bridge. The first city lines used cars of small weight and capacity as compared with those now in use, and the ordinary city street bridges, designed for vehicular traffic, were of ample strength to carry them; but the weights and capacities of the cars used have rapidly increased, more so in the case of the interurban companies than in that of the urban companies, the former using greater speed and requiring motors of greater capacity and weight, and larger and heavier cars. Only a few years ago, cars weighing 20 tons, total load, distributed on eight wheels, represented the heaviest in use. To-day, cars 46 ft. long, weighing, when loaded, about 40 tons, distributed on eight wheels, are in common use on interurban lines, and as nearly all of these cars pass through the cities over the urban street car lines, it is necessary to examine into the city bridges to carry them, as well as the county bridges which are used by the railroad company.

But this does not seem to be the limit of loading for many of these lines, as very many of them carry freight traffic at present and many more will in the future. Some of them are now carrying coal and in some regions the railroad officials expect the coal traffic to be quite an item in their operation; in fact, there seems to be a tendency, in many cases, to approach steam railroad conditions of loading.

When the railroad line left the highway, it became necessary for the company to erect bridges of its own. Many of them, failing to profit by the expensive experience of the steam railroads, have built these bridges for present needs only. They have made no provision whatever for future increase in loading, and designed them for passenger and express traffic only, when it is quite probable that, in the near future, it may be desired to haul heavy freight loads over the line.

What is the probable maximum loading which a given bridge will be required to carry, not just at the present time, but within a length of time representing a reasonable life for the structure? This is a difficult question to answer in most cases, and yet it is essential that it should be answered in order to properly design the structures for any given line, and it is a question that should be answered by the railroad officials, who are in a position to know what sort of traffic they may expect to run over their road in the future.

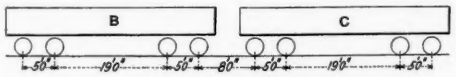
The writer has given this question of loading considerable attention, and proposes that one of the loads given in the table following, taken from the specifications of the Osborn Engineering Company for electric railroad bridges, should be adopted.



Live Load "A."

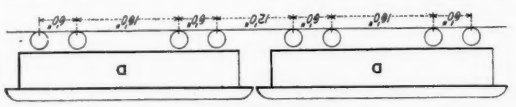
Train of 74-ton Coal Cars.

Weight of Car	38,000 lbs.
Rated Capacity	100,000 lbs.
Ten per cent. Overload	10,000 lbs.
Total Load	148,000 lbs.
Axle Load	37,000 lbs.



Live Loads "B" and "C."

	62-ton Coal Cars.	*46-ton Coal Cars.*	
		"B"	"C"
Weight of Car		36,000 lbs.	26,000 lbs.
Rated Capacity		80,000 lbs.	60,000 lbs.
Ten per cent. Overload		8,000 lbs.	6,000 lbs.
Total Load		124,000 lbs.	92,000 lbs.
Axle Load		31,000 lbs.	23,000 lbs.



Live Load "D."

40-ton Motor Cars.

Axle Load	20,000 lbs.

Loading "A," heavy coal traffic; loading "B," occasional coal cars; loading "C," ordinary freight cars but none exceeding 60,000 lbs., excluding coal traffic; loading "D," passenger and express traffic only.

These loads range all the way from a train of 40-ton passenger cars, designed for a road devoted exclusively to passenger and express traffic, to a loading, consisting of a train of 50-ton capacity coal cars for a road expecting to carry a heavy coal traffic. A point that should be borne in mind is the possible use of electric locomotives, which may have concentrations approaching very closely those of the heaviest coal cars.

Before discussing these loadings further, let us see what is the effect of some of the heavy cars now being operated upon existing bridges. In the majority of cases, bridges are strong enough to carry the loads which are being run over them, or it is possible to make them so with slight changes or repairs, but there are many cases where bridges are seriously overloaded.

The most common point of weakness in a bridge designed for highway traffic and later used for electric railroad traffic is in the floor system and its connections, the greater concentrations of the live load in the case of the electric car over the concentrations of the load used in proportioning highway bridges being responsible for this.

To illustrate the effect of these street car loads upon some highway bridges, we will take eight bridges examined by the writer during 1902. All of these eight structures were figured for loadings actually being run over them or proposed to be used in the immediate future.

1. Through highway span, 108 ft. long, 20 ft. roadway and two 5-ft. walks. Iron Fink trusses; railroad track on one side of the roadway next to the trusses; live load, one 25-ton double truck motor and 60 lbs. per sq. ft. on sidewalks and on that portion of the roadway not occupied by the street railroad tracks.

This loading caused, in the main members of the trusses, a unit stress amounting to 25,000 lbs. per sq. in., not including the effect of impact. The elastic limit of the material was probably about 27,000 lbs. per sq. in.

2. Highway bridge, 195 ft. long, 20 ft. roadway, no sidewalk, Pratt trusses; one track at one side of the roadway; material, iron. Live load consists of two double truck cars, weighing 36 tons each, including passengers, and 60 lbs. per sq. ft. on the unoccupied portion of the roadway.

This loading gave, in the floor system, a unit stress of 22,000 lbs. per sq. in., and, in the main truss members, 27,800 lbs. per sq. in. Owing to the greater impact on the floor, the actual stress in the floor system was probably in excess of that in the main members. The elastic limit of the material was probably about 27,000 lbs. per sq. in.

3. Highway bridge, built 1886, 123 ft. span, 15 ft. roadway; material, iron. Designed for two 36-ton double truck motors, including passengers, and no other load on the bridge; unit stress 21,000 lbs. per sq. in. in the floor system and 11,000 lbs. per sq. in. in the main truss members.

4. Highway bridge, built in 1900, 233 ft. span, 20 ft. clear roadway, no sidewalks; material, steel. Figured for same live load as preceding bridge, and 60 lbs. per sq. ft. on that portion of the roadway not occupied by the street railroad tracks. Unit stress 16,400 lbs. per sq. in. in the floor system; unit stresses in the truss members from 18,000 to 27,000 lbs. per sq. in., excepting one member, a counter rod, which was stressed 41,000 lbs. per sq. in. A comparison of these two bridges, one

*Extracts from a paper by W. J. Watson, read before the Civil Engineers' Club of Cleveland, January, 1903.

built in 1886 of iron and the other built in 1900 of steel, is edifying; the older bridge being very much stronger than the newer.

5. One span, 158 ft. long, 15 ft. roadway, through Pratt truss built in 1881; the same load as preceding bridges; maximum unit stress in the floor, 25,000 lbs. per sq. in.; in the trusses 14,500 lbs. per sq. in.

In the case of this bridge, the members of the floor system, which are so highly stressed, were additions made when the electric railroad was built. They are not nearly so strong as the old portions of the structure.

6. Highway bridge, 233 ft. long, 20 ft. roadway and two sidewalks. Through Whipple trusses. Figured for a live load consisting of one 20-ton car and 60 lbs. per sq. ft. on that portion of the roadway not occupied by the street railroad track.

This loading caused unit stresses as follows: 37,500 lbs. per sq. in. in floor system: 20,400 lbs. in the truss members. It is difficult to say what kept this structure standing, as the elastic limit of the material could not have been much in excess of 27,000 lbs. per sq. in., and the safe capacity of this bridge was not much in excess of 30 lbs. per sq. ft. uniform load, yet cars of very nearly this weight were actually running over the bridge, though operated with great care.

7. Highway bridge, 202 ft. long, 20 ft. roadway; two 6 ft. sidewalks; Whipple truss.

This was a city bridge, and carried one street car track in the center of the roadway. The live load assumed was two 40-ton cars and 60 lbs. per sq. ft. on the unoccupied portion of the roadway and sidewalks. The maximum unit stress in the truss members was about 18,000 lbs. per sq. in., and in the floor system about 25,000 lbs. per sq. in.

8. This is a highway bridge, 203 ft. span, 18 ft. roadway and two 6 ft. sidewalks, and subject to heavy traffic. The live load assumed consisted of one 15-ton street car on a 7-ft. wheel base and 30 lbs. per sq. ft. on the unoccupied portion of roadway and sidewalks, or one motor as above described and one 5-ton wagon on the bridge, whichever would give the greater stress. The stresses found were 23,000 lbs. per sq. in. in the floor system and 27,000 lbs. in the main truss members. The elastic limit of the material was about 27,000 lbs. In this case also, the loads assumed were those actually being run over the bridge.

The matter of impact, that is, the increase in live load stresses produced in a structure by the pounding of the wheels, the swaying of the car, etc., is of as great importance in the design of electric railroad structures as in the design of steam railroad structures. In the case of bridges located in a sag of the grade, as many such bridges are, on electric lines, the impact is still further increased by the momentum of the car.

In many specifications this matter of impact is not properly provided for. In the practice of the Osborn Engineering Company the impact is taken care of by adding to the live load stress a percentage determined by the formula

in which

$$I = \frac{L\,(L)}{L+D}$$

I = the impact to be added to the live load stress,
L = the live load stress,
D = the dead load stress.

This formula is correct in theory, and has been found to satisfy the requirements of practice very well.

The term "factor of safety" of a bridge is misleading, and is absolutely meaningless unless the effect of impact has been fully taken care of in calculating the live load stress. As ordinarily used, it means the ratio of the ultimate strength of the material, when tested to destruction, to the actual stresses in the bridge caused by the dead and live loads, not considering impact.

In the first place, it is not possible to strain steel repeatedly above its elastic limit without causing failure, and therefore the factor of safety should be based upon the elastic limit and not upon the ultimate strength of the material.

In the second place, it is necessary to take the effect of impact into full consideration in order to determine the actual stress in each member of the bridge.

Complying with these two conditions, the bridges designed under the specifications which follow have a factor of safety of two, based upon the elastic limit of the material and taking the effect of impact fully into account. The writer believes that these bridges are much stronger and better proportioned throughout than bridges designed for this same loading with a specified factor of safety of four, as ordinarily understood, or perhaps, misunderstood. The clauses referring to clearance, quality of material and grade of workmanship and the general conditions governing contract work all follow very closely the standard specifications for steam railroad bridges. The following review gives the most salient features of these specifications for electric railroad bridges.

The requirements for clearance are identical with those now adopted by the leading steam roads, 21 ft. vertical and 15 ft. lateral, clear room.

The table of loadings provides for the impact by the use of the formula given above. The effects of centrifugal, longitudinal and wind forces are also taken into consideration.

A unit stress of 17,000 lbs. per sq. in. is used for soft steel members in tension, this allowed unit stress being increased to 19,000 lbs. for medium steel, the corresponding stresses used for steam railroad bridges being 15,000 and 17,000 lbs. per sq. in., respectively. This increase in the allowed unit stresses over those used for steam railroad bridges may seem to be somewhat inconsistent with what has been said in regard to the design of these bridges, but in proportioning bridges for steam railroad use a lower unit stress is used to leave some room for increase in the live load over the loads now actually running, which approach very closely to the typical loads used in proportioning the structure, while in designing electric railroad bridges we have assumed a loading which we think fully covers the probable, if not the possible increase in loads which may reasonably be expected to take place. Furthermore, the loads are not applied in such rapid succession as in the case of steam railroad bridges. Therefore we are warranted in using a higher unit stress. For compression members, the above unit stresses are decreased by Gordon's formula for columns. Members subject to alternate strains of tension and compression in quick succession are given a section equal to that required to resist the sum of these stresses.

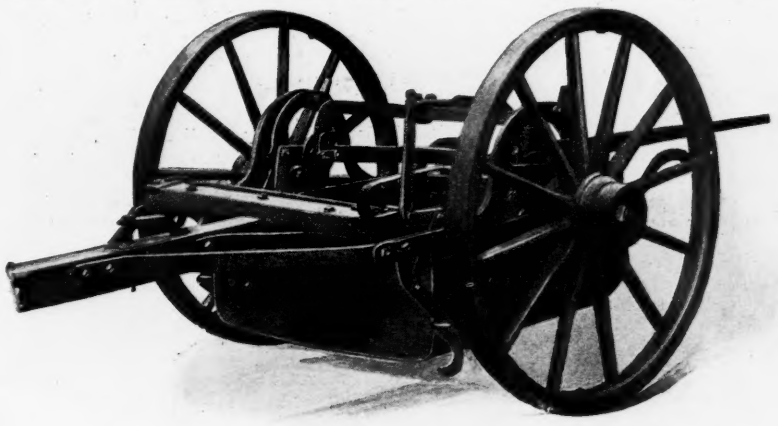
In the use of soft steel all holes in tension members less than ¾ in. thick are to be sub-punched and reamed. In metal ¾ in. and over they are to be drilled from the solid. All holes in compression members may be punched full size up to ¾ in., and for thicknesses of ¾ in. and over must be drilled from the solid. In the case of medium steel, full-sized punching of rivet holes is not allowed in main members.

Requirements as to quality of material, conform closely to those recommended by Committee No. 1 American Section of the International Association for Testing Materials, and to the specifications of the American Association of Steel Manufacturers.

In regard to paint, a very important item, the practice of the Osborn Engineering Company is to give the material one coat of graphite or carbon primer at the shop and two coats in the field, the quality and color of the latter being specified by the engineer for each individual case. Inaccessible surfaces are given two coats of red lead and oil. In all other requirements the specifications follow closely accepted practice in steam railroad bridge design.

The Stubbs Patent Wheeled Scraper.

The illustration shows a new wheeled scraper, which it is claimed has several advantages over other scrapers. It was patented in September, 1900, by Mr. Jesse Stubbs, an old contractor of Mount Pleasant, Iowa, and



The Stubbs Patent Wheeled Scraper.

is being made by the Mechanical Manufacturing Company of Chicago.

In loading the scraper it is drawn by the lower hooks from the mouth of the pan; but while being raised to a carrying position the draft is transferred to a point above and behind the axle, and the pan is locked by the upper hooks so that it cannot dump while the load is being moved. To dump, the safety hooks are detached by a lever, and the team which is pulling from the top of the load, pulls it over, thus enabling the driver to do his own dumping unassisted. The scraper is especially adapted to levee and embankment work, as it dumps easiest going uphill; and it can be used in gravel where the tendency of most scrapers is to slide in dumping. A No. 3 scraper holds 16 cu. ft. of earth and can be operated by one man. It is claimed that its use saves wear and tear on horses and equipment, as in dumping, the pole has a steady forward movement, thus avoiding the jerky motion that gives the horses sore necks.

TECHNICAL.

Manufacturing and Business.

The Independent Railroad Supply Company has recently shipped a number of car loads of Wolhaupter rail joints to the Great Northern.

The Sinaloa Railway & Smelting Co., Augusta, has been incorporated in Maine with a capital of $1,500,000. F. L. Dutton and M. H. Simmons, are incorporators.

The Phoenix Railway Supply Company, of New York, has been incorporated, with a capital of $60,000, to make and deal in railroad supplies, by Walter F. Welch, Liston LaLevis, and others.

One thousand bridges, single and double track, plate girders, lattice and pin trusses, varying in length from 10-ft. span to 300-ft., are offered by C. N Green, 1947 Broadway, New York City.

C. W. Owston has been appointed Superintendent of the Railway Steel Spring Company's new works in East St. Louis, Ill., which were started Nov. 1. Otto Smith has been appointed assistant to the Superintendent.

The Reciprocating Rotary Engine Company, New York City, has been incorporated with a capital of $100,000 in New York, to deal in various kinds of motors. C. F. Jewett, A. M. Davidson, of New York City, and others are directors.

The Midland Railway Construction Co., of Dubuque, Iowa, has been incorporated with a capital of $250,000 to build and operate railroads. The directors and incorporators are: Peter Kiene, Henry Kiene, Paul Kiene, Stephen B. Howard and Charles L. Niles, all of Dubuque.

The Electric Block Signal & Semaphore Company, of Jersey City, has been incorporated, with a capital of $250,000 in New Jersey, to make electrical instruments. Henry W. Robert, Mortimer M. Kinsey, of Jersey City, and others are incorporators.

The Continuous Transit Securities Company, of New York City, has been incorporated, with a capital of $500,000, in New York, to equip street railroads with continuous moving platforms on railroads. A. P. Cobb, Henry C. Eldert, of New York City, and others, are directors.

The New York Car Wheel Company of Buffalo has been incorporated with a capital of $300,000, J. H. Berry and Bernard Ginsburg, of Detroit, and Solomon Ginsburg, of Buffalo, being directors. This appears to be the reorganization of the New York Car Wheel Works which was put in the hands of a receiver recently.

Andrew Wheeler, a well-known iron merchant, died from heart disease at his home, in Philadelphia, on the 21st inst. He was 70 years old and for many years was a member of the firm of Morris, Wheeler & Co., iron merchants. He was also a member of the National Board of Trade, the Philadelphia Board of Trade and the Union League.

The American Steam Gage & Valve Mfg. Company, owing to increased business, are removing their entire plant and offices from Bismark street, Roxbury district, to larger buildings at 208-220 Camden street, Boston, Mass. The Mowry & Phillips foundry department will also be removed from South Boston, and all branches consolidated at the Camden street factory. At the new plant the output of valves, gages and indicators, also special metals and foundry work in the Mowry & Phillips department, will be about double the present capacity.

In the week November 9-14 the Sherwin-Williams Company held, at its office in Cleveland, its "annual convention," which has come to be one of the institutions of this extensive establishment. This was the 23d gathering of the kind, and department managers and other representatives were present from all parts of the United States and Canada. There was a very general feeling that prospects in the paint and varnish trade are good. No representative had any premonition of hard times, and the company feels confident for the future. Since 1898 the average increase in all departments of the concern has been 200 per cent. In the last year entirely new paint and varnish plants and a dry color works, the largest in the world, were built at Chicago; a new paint plant, which will be the largest plant of its kind in Canada, is now being erected at Montreal; the plant at Newark was extended so as to double its capacity; new general offices are under construction at Cleveland, and offices and warehouses are established at San Diego, Cal., and London, Eng. The convention closed with a banquet in the auditorium of the Cleveland Chamber of Commerce to the representatives and all the Cleveland employees of the company. Over 700 were in attendance.

The Circuit Court for Wayne County, Michigan, issued an injunction on Nov. 17 in favor of the Detroit Lubricator Co., restraining the Michigan Lubricator Co. from using the words "Detroit Lubricators," "Improved Standard Lubricators," "Detroit Improved Standard Lubricators," in connection with its lubricators or advertising matter; also from using boxes or packages for lubricators bearing the words "Detroit" or "Detroit, Mich.," unless the firm name be also given.

Iron and Steel.

The plant of the Shelby Steel Tube Company at Greenville, Pa., has resumed operation after a two months' shut-down.

The Eleanor Steel Co. plant at Irwin, Pa., which has been shut down for six months, will soon re-open; and a billet bill, pit rail mill and two open hearth furnaces, which have been added, will be in operation in December.

Reports from Worcester, Mass., state that J. O. Manuel Trotz has resigned as Chief Metallurgist of the United States Steel Corporation, and is negotiating with local capitalists for the building of a large steel and wire plant in Worcester. Mr. Trotz was Superintendent of the

American Steel & Wire plant at Quinsigamond (Worcester) until 1902, when he accepted the position from which he now resigns.

At its South Sharon works the Carnegie Steel Co. is building five new open hearth basic steel furnaces. When completed the company will have 17 furnaces in this plant, making it second only in size to the group at the Homestead plant. The new furnaces will increase the capacity of the company about 25 per cent. The construction work is being done by the American Bridge Co., and the cost will be about $250,000.

New Worthington Plant at Harrison, N. J.

An extensive pump manufacturing plant is now under construction at Harrison, N. J., for the firm of Henry R. Worthington. Between 4,000 and 5,000 men will be employed, and the plant will cost nearly two million dollars. It consists of a main machine shop with side galleries, 1,006 ft. long, an erecting shop 592 ft. long and of the same cross-section as the machine shop and a high erecting shop 210 ft. long with four galleries one above the other in the side bays connecting the two shops. The main foundry is 600 ft. long, and there is also a special foundry for small work, 410 ft. long, with a building connecting the two 200 ft. x 60 ft., to be used for cleaning castings. The pattern building is four stories high and 550 ft. long, and is divided by fire walls into four sections. The north section will be used for offices and drafting rooms: the adjoining section for the pattern shop and the balance of the structure for pattern storage. The power house, which will be equipped with the most modern boilers, engines and generators, is 172 ft. x 102 ft. Electric power distribution is to be employed throughout, and the grounds will be lighted by electric arc lights. There are several other buildings which will be used for packing, storing and shipping goods, etc. The buildings are so arranged that additions can be built whenever necessary. All the buildings will be connected by a complete system of railroad tracks in direct communication with the Delaware, Lackawanna & Western, the Erie and the Pennsylvania railroads. The new plant will be devoted entirely to the manufacture of water works machinery, water meters, cooling towers, condensers, feed-water heaters, centrifugal pumps and steam pumps of all kinds.

Nickel Steel Boiler Tubes for the Navy.

The Navy Bureau of Steam Engineering is about to place an order for nickel steel boiler tubes and condenser tubes to be installed on one of the vessels plying in home waters so that the tests which will be made can be under constant supervision. A careful comparison will be made of this material and the simple steel tubes now in use.

Electrical Equipment for the New York Central.

The New York Central has placed an order with the General Electric Company for eight turbo-generators, of a capacity of 7,500 h.p. each. The turbines are of the four stage, vertical, Curtis type. The generators are 25 cycle, 3 phase, generating current at a pressure of 11,000 volts. This is by far the largest order for steam turbines ever placed in this country or abroad.

The New York Central has also ordered 30 electric locomotives which are to be built by the General Electric Company in co-operation with the Schenectady Works of the American Locomotive Company. These locomotives are of an entirely new design and will weigh 85 tons each, with an adhesive weight on the drivers of 67 tons. Each locomotive will exert 2,200 h.p. and will be capable of hauling a train of 500 tons at a speed of 60 miles an hour. This is also the largest order for electric locomotives ever placed.

THE SCRAP HEAP.

Notes.

Press despatches of Nov. 22 announce that the quarantines against yellow fever which for several weeks have interrupted railroad traffic in Texas have been removed.

The Cleveland, Cincinnati, Chicago & St. Louis has advanced the pay of certain conductors, enginemen and brakemen, the gross increase amounting, it is said, to $140,000 annually.

According to a Philadelphia paper the General Manager of the Pennsylvania has had a conference with a grievance committee of a new breed; one representing the baggage agents and freight agents on the lines of the company east of Pittsburg and Erie.

The Central Car Service Association (The St. Louis Demurrage Bureau) has announced that demurrage will hereafter be charged on all bulk freight, and also announces regulations for charging storage in freight houses after 48 hours, both in St. Louis and East St. Louis.

It is announced that the trunk lines have renewed for the coming year their agreement, first made in 1902, to refrain from issuing passes to the officers of other railroads. It is stated that in general the agreement has proved satisfactory, although it seems to be admitted that there have been some exceptions to the rule.

The passenger representatives of the Pennsylvania (East and West of Pittsburg) have organized an association with J. R. Wood, Passenger Traffic Manager, as Chairman; General Passenger Agents E. A. Ford and George W. Boyd, Vice-Chairmen, and Advertising Manager F. N. Barksdale, Secretary.

The railroads of the Trunk Line and the Central Traffic associations have agreed to make a reduction of 33⅓ per cent. in the rates on iron and steel articles for export, the new rates to go into effect December 1. This reduction applies to all articles shipped by the furnaces, except rails, and the question of making a reduction on rails is now under consideration.

The Grand Jury of Essex County, New Jersey, has made a presentment alleging unsafe conditions at the Clifton avenue crossing in Newark, where occurred, last February, the collision in which nine school girls were killed. According to the newspaper reports the presentment says that the street railroad company has put in a derailing switch, but that "nothing else has been done."

The movements of trains over the very busy line of the Pennsylvania between West Philadelphia and Broad Street were badly disarranged for several hours on Nov. 19, by the destruction of the signal cabin at Powelton avenue. The cabin, which contained the electro pneumatic interlocking machine, was destroyed by fire. The fire was started by gas leaking from a pipe and coming in contact with the flames in the heater.

A train loaded with export cotton was recently run over the New York Central from Valleyfield, Quebec, to New York in 16 hours and 20 minutes. The distance is 435 miles. Two hundred bales of Egyptian cotton were in store at Valleyfield, a few miles south of Montreal. They had been sold to Liverpool spinners and in order to make delivery it was necessary to get the cotton to New York within 17 hours.

The Iowa Railway Club Journal.

The Proceedings of the Iowa Railway Club are henceforth to be issued by A. More, who intends to transform it into a publication of general interest to Iowa. It will be known as the Iowa Railway Club Journal. Mr. More will add an editorial department, and will publish general news of the Iowa railroad field, as well as other matters of interest to railroad men.

Signals in Texas and Elsewhere.

The Taylor Signal Company of Buffalo, N. Y., has taken a contract to install an all-electric switch and signal plant at Fort Worth, Texas, with a machine of 125 functions. This interlocking will be at the crossing of the Texas & Pacific, Gulf, Colorado & Santa Fe, Houston & Texas Central, and Missouri, Kansas & Texas Railroads. Since the enactment of the Texas law requiring interlocked signals at crossings, the Railroad Commissioners of that State have approved plans for signals at 67 crossings. Twenty-nine of these plants, 17 manual and 12 electric, are now in operation. They aggregate 600 levers.

The Terminal Railroad Association of St. Louis has decided to equip with automatic signals all of its main lines both east and west of the Mississippi River.

The St. Paul Union Depot Company, St. Paul, Minn., has completed its plans for an elaborate interlocking system for the station yards and approaches.

Transport says that the Northern Railroad of France has contracted for some low pressure pneumatic interlocking.

Prosecutions Under the Safety Appliance Law.

Press despatches from Texas report that District Attorney Atwell, of the Northern District of that State, has filed in the Federal Court a suit against the Gulf, Colorado & Santa Fe to recover the statutory penalty for violating the law in running cars from the Indian Territory to Texas not equipped according to law. The accounts do not say what particular safety appliance the cars lacked.

Fatal Collision on Brooklyn Elevated.

On Thursday night, November 19, about 5 o'clock, a rear collisfon of electric trains on the elevated railroad of the Brooklyn Rapid Transit Co., in Brooklyn, at Fifth avenue and 30th street, resulted in the destruction of four cars by fire and the death of the conductor and motorman of the second train. These men appear to have been burned to death, as their injuries in the collision were not apparently fatal. The leading train was empty and there were but few passengers in the foremost car of the second train. Eight of these were injured. The leading train had been stopped by the blowing out of a fuse, but the red tail lights were in position, and the motorman of the following train appears not to have been keeping a good lookout; although, as he is dead, and there are no competent witnesses, the officers of the company have been unable to determine the precise reason why he did not control his speed. The fire was started by the power conductor having been short circuited when the cars were knocked off the track. The State Railroad Commissioners have begun an inquiry into this accident and the evidence before them is said to show that the motorman was in good health and had had sufficient rest.

Disastrous Collision at Tremont, Ill.

On Thursday afternoon, November 19, a butting collision between a freight train and a work train on the Cleveland, Cincinnati, Chicago & St. Louis between Tremont and Mackinaw, Ill., caused the death of 20 or more laborers on the work train and the injury of 15 others. The boiler of the work train engine exploded immediately after the collision. It is said that the freight ran past a station at which it had been ordered to wait for the work train.

The Kentwood Collision.

Reports from New Orleans, November 16, give the number of persons killed in the collision at Kentwood, La., on the 14th, as 30, and of injured 18. Included in the dead are one white man and one white woman, the latter unidentified. All the rest were negroes. The trains in collision were northbound, the foremost being accommodation train No. 32, leaving New Orleans at 3.50 p.m. This train was much behind time, and was run into by No. 6. The line approaching Kentwood from the south is straight for many miles until near the station, where it curves. An officer of the road is quoted as follows: "Both these trains were of the same class. Both were in their places, and there is no blame in that direction.

"Neither train was violating any rule so far as the movement of the trains was concerned. There is no fault to be attached to the operators or the train despatchers in properly spacing the trains. When they passed Tangipahoa they were seven or eight minutes apart.

"The conductor of No. 32 had orders to keep ahead of No. 6, which, unless otherwise changed, held good until destination. No. 32 had been badly delayed in its local work. The number of sample trunks and things of that kind had delayed her until the train was some minutes late. The conductor testifies that he ordered his flagman back at Kentwood. The flagman says he went. No. 6 was hauled by one of our largest passenger engines. She was composed of five cars, and runs at a high rate of speed. She does not stop at Kentwood.

"There was a train on the right siding at Kentwood, which also had out markers, and these are supposed to have confused the engineer of No. 6. Engineer Jones, on No. 6, testified that there was a confusion of lights at Kentwood, and that he did not see the red lights on the rear of No. 32 until he was right at her. But he had between 2,000 and 2,500 ft. in which to stop his train of five cars. It could have been done." The required time interval was five minutes.

Underground Telegraphs in England.

The British Post Office is to build underground telegraph lines between Warrington and Carlisle, and Manchester and Leeds. The cost of the work, together with a 20-mile extension to Beattock Rise, is estimated at $675,000. These three sections cover about 120 miles, and the cost is considerably less than a few years ago, as the 113 miles from London to Birmingham cost $800,000. It is probable that the underground system will be extended in the direction of Portsmouth, Bristol and Land's End, as recent storms have interrupted communication in the south of England.

Murders and Robberies.

On the night of November 19, William Clendennen, signalman at Brown's, a lonely station on the New York Central near Williamsport, Pa., was murdered at his desk. On the same night a murderous attack was made on night operator Hafer, at Allenwood, on the Philadelphia & Reading, and on the next night an operator was robbed at Girardville, Pa., also on the Reading. A number of arrests have been made but at this writing neither the police nor the railroad detectives appear to have found any clue to the perpetrators of the crimes.

On Sunday night, November 16, near Collier, W. Va., obstructions were fastened on the track of the Pennsylvania, with the evident intention of derailing passenger train No. 25. Section Foreman Pentoney, who heard noise made by the wreckers, started to investigate and was fatally wounded by a gun shot. The wreckers then ran away.

On the night of November 21 the conductor and a brakeman of westbound passenger train No. 11 of the Vandalia Line found in a mail car, after leaving Indianapolis, two masked men who, presenting pistols, ordered the train to be stopped. After the stop, however, the presence of the other trainmen and of a number of passengers appears to have scared the would-be robbers, and they escaped to the woods.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular mettings of railroad associations and engineering societies see advertising page xvi.)

Southern Railroad Commissions.

The Association of Railroad Commissioners of the Southern States at its annual convention in New Orleans last week re-elected N. W. Baptist, of Tennessee, President, and J. A. Webb, of Mississippi, Secretary. The association will meet next year at St. Louis at a time to be named by the President.

New York Railroad Club.

At the annual meeting of the New York Railroad Club Nov. 20 the following were elected: President, H. H. Vreeland; First Vice-President, J. F. Deems; Second Vice-President, A. M. Waitt; Third Vice-President, W. L. Derr; Treasurer, R. M. Dixon; Executive Committee, Geo. W. West, W. M. McIntosh, W. W. Snow; Finance Committee, W. B. Albright, O. C. Gayley, R. L. Thomas. There were no formal papers, and the reports for the year and remarks of the President constituted the chief business of the evening, at the close of which supper was served, as usual.

1904 M. C. B. and M. M. Conventions.

The executive committees of the Master Car Builders' and American Railway Master Mechanics' associations met at the Hotel Manhattan, New York City, Nov. 23, and decided that next year's conventions be held at Saratoga Springs, N. Y. The Master Car Builders will meet June 22 to June 24 inclusive and the Master Mechanics June 27 to June 29 inclusive. The Grand Union Hotel will be headquarters and applications for rooms should be addressed to Messrs. Woolley & Gerrans, Hotel Marie Antoinette, New York City. The rates are the same as last year: Single room, without bath, one person, $4 a day; single room, with bath, one person, $5; double room, without bath, one person, $5; double room, without bath, two persons, $8; double room, with bath, one person, $6; double room, with bath, two persons, $10; extra large double room, with bath, two persons, $12.

The United States Hotel will open in time to accommodate members and guests. Those wanting rooms at a rate less than $4 a day should apply to any of the following: Congress Hall, American-Adelphi Hotel, Hotel Worden. Applications for space for exhibits should be made to J. Alexander Brown, Secretary Supplymen's Association, 24 Park Place, New York City.

PERSONAL.

—Mr. Andrew J. Odell, who in 1877 was Secretary of the Delaware, Lackawanna & Western, died on Nov. 23, in New York City, at the age of 71. Mr. Odell was connected with the Lackawanna about 20 years.

—Mr. A. P. Carter, Claim Agent of the Norfolk & Western, died in Roanoke, Va., Nov. 20, at the age of 48 years. He was a native of Beardstown, Ill., and had been with the Norfolk & Western for a number of years.

—Mr. W. E. McGraw, Superintendent of Terminals of the Colorado & Southern, at Denver, Colo., began his railroad service on the Chicago, Milwaukee & St. Paul in 1882. He served on the Chicago Great Western and the Wisconsin Central and at the Stock Yards at Chicago. In 1900 he went to the Rio Grande Western, and then was General Yardmaster on the Denver & Rio Grande. This position he now resigns to become Superintendent of Terminals of the Colorado & Southern.

—Mr. L. S. Allen, formerly General Passenger Agent of the Seaboard Air Line, died at his home in Chicago, Ill., on Nov. 21, at the age of 53 years. His early railroad experience was on the Lake Shore & Michigan Southern, where he began in 1866 as agent. In 1882 he was in the passenger department of the Baltimore & Ohio and remained with that company until 1890, when he left to go to the Seaboard Air Line as General Agent at Washington. Two years later he was promoted to be General Passenger Agent, from which position ill health compelled him to resign a few years ago.

ELECTIONS AND APPOINTMENTS.

Arizona & Colorado.—The headquarters of President E. Randolph have been removed from Los Angeles, Cal., to Naco, Ariz.

Central of Georgia.—President John M. Egan has been granted leave of absence. It is understood, according to press despatches, that Mr. Egan has retired from the road.

Chicago, Burlington & Quincy.—R. L. Porter has been appointed Superintendent, with headquarters at Galesburg, Ill., succeeding the late Mr. Kimber.

Chicago, Milwaukee & St. Paul.—F. Horton, Superintendent, with headquarters at Des Moines, Iowa, has resigned.

Chicago, Rock Island & Pacific.—W. H. Davisson, hitherto Assistant Chief Engineer, has been appointed Principal Assistant Engineer of Maintenance of Way, with headquarters at Chicago, succeeding C. G. Delo, resigned.

Choctaw, Oklahoma & Gulf.—C. J. Hogue, Assistant Engineer of Maintenance of Way, with headquarters at Little Rock, Ark., has resigned.

Colorado & Southern.—At a meeting of the Directors held recently, J. P. Cotton, Jr., was elected a Director, succeeding J. Kennedy Todd.

Delaware & Hudson.—A. Buchanan, Jr., Master Mechanic, with headquarters at Green Island, N. Y., has resigned.

East Broad Top.—R. S. Siebert, General Manager, will also assume the duties of President.

Houston & Texas Central.—W. H. Taylor, hitherto Acting General Freight Agent, has been made General Freight Agent.

Leavenworth, Kansas & Western.—W. S. Basinger, General Freight and Passenger Agent, has been appointed Superintendent, also, with headquarters at Leavenworth, Kan., succeeding J. H. Brinkerhoff, resigned.

Lehigh Valley.—J. M. Baxter has been appointed Assistant Treasurer, with headquarters at Philadelphia, Pa., succeeding F. E. Knorr, assigned to other duties.

George R. Chesbrough, hitherto Western Passenger Agent in Buffalo, has been promoted to succeed A. A. Heard, as General Eastern Passenger Agent in New York. Mr. Chesbrough is succeeded at Buffalo by W. B. Wheeler, hitherto Northwestern Passenger Agent at Chicago.

Mobile, Jackson & Kansas City.—W. W. Hayden has been appointed Chief Engineer, with headquarters at Mobile, Ala., succeeding H. S. Jones, resigned.

Northern Pacific.—T. J. Cutler, hitherto Master Mechanic at Fargo, N. Dak., has been appointed Master Mechanic, with headquarters at Missoula, Mont., succeeding W. F. Buck. J. E. O'Brien has been appointed to succeed Mr. Cutler at Fargo.

Pere Marquette.—J. Boughton has been appointed Assistant Auditor.

Southern Indiana.—H. Knowles has been appointed Car Accountant, with office at Terre Haute, Ind.

Union Pacific.—Charles Ware has been appointed Assistant Superintendent, with headquarters at Omaha, Neb., succeeding H. C. Ferris, promoted, and Mr. Ware in turn is succeeded as Assistant Superintendent at North Platte, Neb., by E. Stenger.

LOCOMOTIVE BUILDING.

Thebaud Bros., New York, are having five locomotives built at the Baldwin Works.

The Canadian Copper Company is having two locomotives built at the Baldwin Works.

The Toledo, Peoria & Western is having five locomotives built at the Baldwin Works.

The H. K. Porter Locomotive Works, Pittsburg, are building a number of narrow gage locomotives for use on Mexican plantations.

The New York, New Haven & Hartford is having five locomotives built at the Rhode Island Works of the American Locomotive Company.

The Lima Locomotive & Machine Company, Lima, Ohio, is building one 150-ton Shay geared locomotive for the Chesapeake & Ohio for use on mountain grades.

The Savannah Locomotive Works & Supply Company, Savannah, Ga., is reported in the market for a 36-in. gage locomotive weighing eight or ten tons, suitable for running on wooden rails.

The Florida East Coast, as reported in our issue of Nov. 13, is having 10 simple Atlantic type (4-4-2) locomotives built at the Schenectady Works of the American Locomotive Company. These locomotives will weigh 151,000 lbs., with 84,000 lbs. on drivers; cylinders, 19 in. x 26 in.; diameter of drivers, 68 in.; straight boiler, with a working steam pressure of 190 lbs.; 258 knobbled iron, National Tube Co.'s tubes, 2 in. in diameter and 16 ft. long; fire-box, 90 in. long and 60 in. wide; grate area, 37.5 sq. ft.; tank capacity, 5,000 gal. of water and 9½ tons of coal. Special equipment includes Westinghouse-American brakes; Golmar bell ringers; Franklin boiler lagging; National-Hollow brake-beams; Lappin brake-shoes; Washburn couplers; Monitor injectors; Ajax journal bearings, U. S. metallic piston rod and valve rod packings; Ashton safety valves and steam gages; Waters sanding devices; Nathan sight-feed lubricators; Railway Steel-Spring Co.'s springs; Gold steam heat; steel wheel centers and Phillips boiler checks.

CAR BUILDING.

The Hocking Valley will soon be in the market for 200 gondolas.

The Cudahy Packing Company is in the market for 250 refrigerator cars.

The Central of New Jersey is reported to be drawing up specifications for 2,000 cars.

The California & Northwestern has ordered 38 freight cars from the American Car & Foundry Company.

The United Fruit Company has ordered 60 steel underframe box cars from the American Car & Foundry Co.

E. A. Bryan, First National Bank Building, Chicago, is preparing to build five tank cars at his shops at Harvey, Ill.

The Cincinnati, New Orleans & Texas Pacific has ordered one postal car from the American Car & Foundry Co.

The Coeur d'Alene & Spokane has ordered 20 box cars from the American Car & Foundry Co. The headquarters of the company are at Coeur d'Alene, Idaho.

The Morton-Gregson Car Lines, Chicago, as reported in our issue of Nov. 13, have ordered 30 refrigerator cars of 50,000 lbs. capacity from the American Car & Foundry Company. These cars will be 36 ft. long and 8 ft. 11 in. wide. Special equipment includes Common Sense bolsters, Westinghouse brakes, Junior metal brake-beams and Gould couplers and draft rigging.

The Seaboard Air Line, as reported in our issue of Nov. 13, has ordered five combination passenger and bag gage cars from Barney & Smith. These cars will be 60 ft. long, over end sills; 9 ft. 8 in. wide, over side sills, and 14 ft. 3 in. high over all. Special equipment includes National-Hollow brake-beams, Westinghouse air-brakes, Ajax brasses, Acme curtain fixtures, Pantasote curtain material, National couplers, Safety Car Heating & Lighting Company's heating system, Pintsch gas, and Railway Steel Spring Co.'s springs.

BRIDGE BUILDING.

ALLENTOWN, PA.—The Grand Jury recommends the building of a bridge about 1,500 ft. long and 75 ft. high, at Tilghman street, to cost, with the property to be condemned, about $100,000.

AUBURN, N. Y.—The New York Central, to abolish a grade crossing at Van Auden street, may build a footbridge over its tracks at a cost of about $18,000.

DENVER, COLO.—Separate bids are asked by L. G. Carpenter, State Engineer, for the following work: On Dec. 16, for the building of a steel bridge 84 ft. long, with 16-ft. roadway and approaches, over Clear Creek, at the town of Empire, Clear Creek County, Colo.; on Dec. 19, for building a steel bridge over Clear Creek between Adams and Jefferson counties, to consist of two spans of 42 ft. each, with 16-ft. roadway; on Dec. 23, for the building of a steel span for the bridge at Debeque, Mesa County, Colo., 150 ft. long, with 16-ft. roadway, and on Dec. 28, for the building of a steel or combination bridge and approaches, 210 ft. long, of two or more spans, with 14-ft. roadway, over the Rio Grande River near Monte Vista, Cal.

DERBY, CONN.—The bridge committee has under consideration plans for building a bridge over the Housatonic River, at a cost of about $74,000.

DES MOINES, IOWA.—Propositions for the building of bridges are being considered by the City Council which are to cost more than has been spent for bridges in Des Moines during the past 25 years. The bridges now in use cost about $275,000. Plans before the Council at the present time, together with contracts already let, will necessitate an expenditure of $350,000. The bridges under contract are the Sixth avenue (North), $74,000, and East Sixth street, $48,440. The proposed new bridges are as follows: Arch over Des Moines River on Locust street, $100,000; bridge over Des Moines River on State street, $70,000, and bridge over Des Moines River at North Second street, city's share $28,000. It is also proposed to put $10,000 worth of repairs on the covered bridge on South First street. The city will also have to build approaches to the Sixth avenue (North) not provided for in the contract with the construction company.

EUFAULA, ALA.—On Nov. 18 a bill was introduced in the Lower House of Congress authorizing the Brunswick & Birmingham R. R. Co. to build a bridge across the Chattahoochee River at or near Eufaula.

FARGO, N. DAK.—A bill was introduced at Washington, D. C., Nov. 9, and referred to the Committee on Interstate and Foreign Commerce authorizing a bridge across the Red River of the North at Fargo.

FREDERICTON, N. B.—Surveys are being made by W. Harrison, Civil Engineer of the Provincial Public Works Department, for a steel bridge at the head of the first Loch Lomond, also for bridges at Mispec and Black River. Plans will be prepared and bids asked this winter.

GREENFIELD, IND.—Bids are wanted Dec. 12 by the Board of Commissioners of Hancock County, for building about 14 bridges in the county. Moses Bates is a member of the Board of Commissioners.

HARRISBURG, PA.—An ordinance introduced in the Common Council provides for a vote on the question of increasing the city debt $150,000, the proceeds to be used for building the steel viaduct over the Pennsylvania R. R. tracks at Tenth and Eleventh streets and at Walnut street.

HOPEFIELD, ARK.—A bill has been introduced in the House at Washington authorizing the Kansas City & Memphis Railway & Bridge Company to build and maintain a combined highway and railroad bridge over the Mississippi River from a point at or near Hopefield, Ark., to Memphis.

JERMYN, PA.—Petition has been made to the Grand Jury to build a bridge, at a cost of about $14,000, over Rush Brook Creek at Main street.

KENTUCKY.—A bill has been introduced in the Lower House of Congress and referred to the Committee on Interstate and Foreign Commerce authorizing the Norfolk & Western Ry. Co. to build bridges over Tug Fork of the Big Sandy River at points where it forms the boundary between Kentucky and West Virginia.

MEMPHIS, TENN.—The Union Railway Company, local reports state, will build four steel bridges: at Central and Trezevant avenues, over Cooper avenue, over Porter street on Broadway, and over McLemore avenue near Raleigh avenue, in addition to the one over Bayou Gayoso at Front street. There will also be other bridges built by the various roads entering the city. H. G. Fleming is President of the Union Railway Co.

On Nov. 16 a bill was introduced in the Lower House of Congress to amend the bill authorizing a bridge across the Mississippi River at Memphis, Tenn.

MENOMINEE, MICH.—The Marinette County Board of Supervisors has appropriated money for the building of two steel bridges over Marinette River, one between Niagara and Quinnesec, Mich., and another from Norway, Mich., to Marinette County, at a cost of about $34,000 for both.

NAPA, CAL.—The City Council has directed that a vote be taken on a proposal to issue bonds for building a bridge at North Brown and Pearl streets.

NATCHITOCHES, LA.—Bids are wanted Dec. 14, by G. W. Keile, President, Parish Police Jury, for building the protection work for a combined railroad and highway bridge over Red River.

NEWARK, N. J.—County Engineer James Owen has asked the Board of Freeholders to consider the rebuilding of bridges in Essex county damaged by recent floods as follows: South Orange avenue, also at Old Road over the Rahway River; Bloomfield avenue, also Franklin street over Second River, at Bloomfield; Park street, also Kearney street, East Orange; and repairs to bridges at West Passaic avenue, Brookdale; James street, Bloomfield; Dodd street, East Orange; Jeroleman street, Belleville; Avondale bridge over Passaic River, and Clinton avenue and Augusta street bridges at Irvington. The cost of the entire work is estimated at $100,000.

NEW HAVEN, CONN.—The Board of Aldermen, it is reported, will be asked for authority to build a second bridge over West River on Kimberly avenue, at a cost of about $16,000, similar to the new Kimberly avenue bridge soon to be built. C. W. Kelly is City Engineer.

NEW YORK, N. Y.—The Mayor has signed a resolution passed by the Board of Aldermen which provides for the issue of $335,000 in corporate stock, the proceeds to be used for the building of new bridges over Gowanus Canal in Brooklyn.

The bids opened Nov. 13 by the Department of Bridges for building the foundations, piers and abutments of Pelham bridge over East Chester Bay in Pelham Bay Park, Bronx, were: W. J. Lawlor, $208,905; Joseph Gallo, $290,480; Bernard Rolf, $307,130; United Engineering & Contracting Company, $339,485; John J. Hopper, $344,952.

PATERSON, N. J.—Wm. B. Gourley, counsel for the Public Service Corporation, is quoted as saying that the company will build a steel and concrete bridge over the Passaic River at Broadway, for the use of the Hudson River Line, work to commence early in the spring. A temporary bridge will be built meantime to accommodate travel.

PERTH AMBOY, N. J.—A recent meeting was held by officials and residents, of New York and New Jersey, to consider plans for the building of a suspension or draw bridge, subject to the direction of the War Department, over Staten Island Sound between Perth Amboy and Tottenville.

RIVERHEAD, N. Y.—The County Supervisors are considering the question of building a highway bridge over Shinnecock canal at Good Ground, at a cost of about $24,000.

ROCHESTER, N. Y.—A bridge may be built at East Rush street at a cost of about $40,000.

ROCKFORD, ILL.—The Morgan street bridge may be rebuilt by the city, at a cost of about $11,000. E. Main is City Engineer.

SCHENECTADY, N. Y.—The Schenectady Railway Company, if it can arrange matters with the Common Council, may build a steel bridge over Cotton Factory hollow, at a cost of about $30,000.

SYRACUSE, N. Y.—A bridge may be built at Onondaga street at a cost of about $12,000. Address Contractor Thomas Moore.

TERRE HAUTE, IND.—The Cleveland, Cincinnati, Chicago & St. Louis, local reports say, will build an additional bridge over the Wabash River, alongside the one now in use, thus providing a double track over the river.

WASHINGTON, D. C.—Bids are wanted Dec. 28 by Commissioner H. B. F. MacFarland for widening part of the masonry of the Aqueduct bridge.

YANKTON, S. DAK.—A bill has been introduced in the U. S. Senate authorizing the Winnipeg, Yankton & Gulf Railroad to build a combined railroad, wagon and foot bridge across the Missouri River at or near Yankton.

Other Structures.

BALTIMORE, MD.—The Philadelphia, Baltimore & Washington, it is reported, will build a roundhouse and machine shops, to cost about $100,000.

BRIDGETON, N. J.—The Ferracute Machine Company, maker of presses, etc., is building temporary structures

to replace its buildings recently destroyed by fire, to use until arrangements can be made for permanent buildings.

CHATTANOOGA, TENN.—The Wheland Machine Works, Chattanooga, Tenn., is making improvements to its shops. There will be a new foundry 110 ft. x 200 ft.; also a blacksmith shop 50 ft. x 100 ft., and a power house 50 ft. x 105 ft. All the machinery required has been bought.

ELWOOD, IND.—The Lake Erie & Western, local reports state, has bought land on which it will build a new freight house.

HACKETTSTOWN, N. J.—The American Machinery & Export Company, 114 Liberty street, New York, has bought land at Hackettstown, and is building shops for the making of sawmills, agricultural machinery, water wheels and other things.

HOQUIAM, WASH.—The Hoquiam Iron Works Company, reports say, will enlarge its present shops, and build a new foundry. New machinery will also be added.

JOLIET, ILL.—At a recent meeting between the officers of the various railroads entering the city and the city officials, a plan was submitted by the former for the building of a union station and a system of subways in place of the track elevation ordinance now pending.

KISKIMINETAS JUNCTION, PA.—The Pennsylvania R. R., it is reported, is preparing to build repair and machine shops at this place.

LIMA, MONT.—The Oregon Short Line, reports say, will build machine shops and round houses at three division points—at Lima, Mont., to cost about $65,000; at Montpelier, Idaho, to cost about $75,000, and at Glenn's Ferry, Idaho, to cost about $65,000.

MONTEREY, MEXICO.—Plans have been made for the building of a union station in Monterey by the National of Mexico and the Mexican International.

NEW YORK, N. Y.—The Delaware, Lackawanna & Western, local reports say, will build a new ferry house 225 ft. long, south of the Erie ferry at the foot of West Twenty-third street. The structure is to have a steel frame, with a front of copper, and is to cost about $250,000. It is probable that the plans may be altered so as to extend the building to make it 650 ft. long.

NICETOWN, PA.—The Midvale Steel Company has approved the plans for its shops in which to make armor plate. The buildings will be of steel, covered with corrugated iron, on brick and concrete foundations.

PHILADELPHIA, PA.—The N. & G. Taylor Company is making improvements at its works, both at Philadelphia and at Cumberland, Md. At Philadelphia new warehouses, storage rooms, a factory and a blacksmith shop will be added and the tin house enlarged. At Cumberland new annealing furnaces are being built to increase the capacity for black plates. A new warehouse has just been completed for the sheet steel department.

PITTSBURG, PA.—The Pittsburg Valve & Fittings Company, at a recent meeting held in Pittsburg, decided to increase its capital stock from $300,000 to $500,000. The increased capital is to be used for adding a malleable foundry and new equipment in the iron and brass departments. At Barberton, Ohio, the iron fitting department turns out 15 tons a day.

Local reports state that the Pennsylvania has bought land for $2,500,000 at Grant street and Fifth avenue, on which it will build a station. This is in addition to the property recently bought from H. C. Frick by the same company for warehouse purposes.

PRAIRIE CITY, IOWA.—The Dowden Manufacturing Company, it is reported, will build a foundry 62 ft. x 442 ft.

SAN FRANCISCO, CAL.—The Seawall Commission, at a recent meeting, decided to reject all bids and ask new ones for the building of the King street seawall, 600 ft. long, to cost about $100,000. Provision may be made to add 4,500 additional feet.

SOUTH PORTSMOUTH, KY.—The Chesapeake & Ohio is asking bids for a stone and brick station, with slate roof, of one story 26 ft. x 68½ ft., to cost about $10,000.

TOPEKA, KAN.—The Atchison, Topeka & Santa Fe, it is reported, has plans ready for a station to be built of brick. A new freight house will also be built, 42 ft. wide and 300 ft. long, at a cost of about $40,000.

TROY, N. Y.—The Ludlow Valve Company, it is reported, is making additions to its works. There are to be ten new brick buildings, including a foundry 137 ft. x 366 ft. These improvements will enable the company to double its capacity. John T. Christie is Vice-President.

WASHINGTON, D. C.—A contract has been awarded by the Treasury Department to Fissell & Wagner, of New York, for building the new post-office at Northampton, Mass., at $46,000, the work to be completed by Dec. 31, 1904.

WILKESBARRE, PA.—The Delaware & Hudson, local reports say, will build a new station on the site of the Brown block.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ARKANSAS SOUTHERN.—The proposed route of this railroad is from Eldorado, Ark., through Ruston, La., south to Winnfield, 101 miles. Location surveys have been made as far as Alexandria, 45 miles, and contracts for grading will be let within the next six weeks. The maximum grade will be .9 of one per cent., and the maximum curvature 3½ deg. There will be no steel bridges or important trestles. (Official.) G. W. Hunter, St. Louis, is President, and J. A. Knox, Ruston, La., is Chief Engineer. (Nov. 13, p. 822.)

ATLANTIC & BIRMINGHAM.—An officer writes that this company has completed 31 miles of road from Cordele, Ga., northwest to Montezuma. Preliminary surveys have been made for an extension from Montezuma, Ga., west to Birmingham, Ala., 243 miles.

BALTIMORE & OHIO.—The extension which this company has been building from Century, W. Va., south to Buckhannon, 14 miles, has been completed and is now in operation.

BLACK HILLS & WYOMING.—This company, which recently purchased the Dakota, Wyoming & Missouri River, will complete the line between Rapid City and Mystic, S. Dak., 35 miles. Only eight miles of the original road were completed. F. C. Tucker, Deadwood, S. Dak., is Chief Engineer. (Nov. 13, p. 822.)

BLUE ISLAND, RIVERDALE & HAMMOND (ELECTRIC).—Articles of incorporation have been filed by this company in Illinois. It is proposed to build an electric railroad from Chicago southwest to Joliet, 35 miles, with several branches. W. R. Owen, A. W. Miller, M. J. Corcoran and others, of Chicago, are incorporators.

CANADIAN NORTHERN.—An officer writes that grading has been completed for a distance of 40 miles on the extension from Portage la Prairie to Carberry, 51 miles. Track has been laid for a distance of 25 miles, and it is estimated that 15 more miles wil be completed by Dec. 31. H. H. McLeod, Winnipeg, Man., is the Chief Engineer.

CHARLOTTESVILLE & ALBEMARLE.—A charter has been granted this company in Virginia, with headquarters at Charlottesville. C. M. Bolton is President.

CLEVELAND, LORAIN & WHEELING.—An officer writes that the improvements which this company is making at Bellaire, Ohio, consist of a "Y" between the main line of the B. & O., and the C., L. & W. The connection leaves the main line of the B. & O. at the Ohio River bridge by a viaduct, and reaches the grade of the C., L. & W. at a distance of about 1½ miles. It will be double-track, with a maximum grade of .85 of one per cent. Hoover & Kinnear, Columbus, Ohio, have the contract for the masonry work. (Nov. 20, p. 838.)

COAL & COKE.—An officer writes that grading is now in progress between Otter, W. Va., and the mouth of Copen Run, 40 miles, and between Kingsville and Sago Tunnel, 18 miles. McArthur Bros., Chicago, and the Ferguson Contracting Company of Pittsburg, are the contractors. Surveys are in progress between Sago Tunnel and the mouth of Copen Run, 40 miles.

DALTON & ALACULSY.—This company has graded its line from Dalton, Ga., to Crandall, in Murray County, 20 miles. Track laying will be begun at once, and it is stated that the line will be completed early next spring. Connection will be made with the Southern Railway and the Western & Atlantic at Dalton. M. S. Squires is President.

DELAWARE, LACKAWANNA & WESTERN.—This company is reported to have completed plans for elevating its tracks through Orange, N. J. The estimated cost of the work is $1,000,000. The city will be asked to pay $100,000 of this sum. All grade crossings will be abandoned and a new station will be erected between Lincoln and Essex avenues.

DURHAM & CHARLOTTE.—An officer writes that work is now in progress between Little River, N. C., and Troy, 3½ miles, and between Pittsboro, N. C., and Bynum, five miles. Surveys are in progress from Bynum, northwest to Greensboro, 50 miles.

ERIE & CENTRAL.—Press reports state that the interests who recently purchased this road will build extensions from Cincinnatus, N. Y., east to South Otselic, 20 miles, and from Cortland south to Syracuse, 35 miles.

FARMERS' GRAIN & SHIPPING COMPANY.—This company is reported to be making surveys for an extension of its railroad from Starkweather, N. Dak., to Rosedale, 25 miles. The company at present operates 26 miles of line in North Dakota. J. M. Kelly, Garske, N. Dak., is President.

HAMMOND & EASTERN.—The Hammond Lumber Co., of Hammond, La., which owns this railroad, is about to build an extension from the present terminus, four miles east of Hammond to Covington, La., 20 miles.

IOWA CITY, KALONA & WASHINGTON (ELECTRIC).—Surveys have been made for this electric railroad from Iowa City south through Kalona to Washington, 35 miles. It is stated that bids for grading will be asked about Dec. 15. G. C. Rodman, Washington, Iowa, is President. (Oct. 30, p. 786.)

LAWTON, WICHITA MOUNTAIN & WESTERN (ELECTRIC).—Preliminary surveys have been completed for this proposed electric railroad from Lawton, Okla. T., north to Lone Wolf, 75 miles. Rights of way are now being secured, and it is stated that grading will be begun shortly. E. F. Mitchell, Lawton, Okla. T., is Vice-President and General Manager. (Nov. 6, p. 804.)

LITTLE ROCK NORTHERN.—A charter has been granted this company in Arkansas, to build a railroad from Little Rock, Ark., northwest to Springfield, Mo., 280 miles. The authorized capital of the company is $11,000,000. J. M. Ross and C. T. Coleman, of Little Rock, are among the incorporators.

LOUISIANA WESTERN.—An officer writes that work is now in progress between Hayes, La., and Lake Arthur, 15½ miles. W. L. Delerge & Co., Houston, Texas, are the contractors.

MEMPHIS & GULF.—An officer writes that the proposed route of this road is from Grenada, Miss., southeast through Meridian to Pensacola, Fla., about 310 miles. Preliminary surveys are now in progress. Grading will be begun as soon as the location surveys have been completed. The maximum grade will be .8 of one per cent., and the maximum curvature 6 deg. The Gulf States Construction Company, Ltd., which was recently incorporated in Louisiana, will have the general contract for building the road. There will be two steel bridges crossing the Tombigbee and Alabama rivers respectively. Chester H. Pond is President, and H. P. Farrar, Randolph Bldg., Memphis, Tenn., is the engineer in charge of the work. (Nov. 13, p. 822.)

MEMPHIS, HELENA & LOUISIANA.—An officer writes that work is now in progress on an extension from Marianna, Ark., to West Memphis, 49 miles, and from McGehee to Latour, 81½ miles. J. H. McCarty & Co., and the Dalhoff Construction Company of Little Rock, Ark., are the contractors.

MEXICAN ROADS.—A concession has been granted by the Mexican Government to Luis Torres, of Mexico City, for building a railroad from a point near Naco through the Sonora and Moctozuma districts to a point near Los Pilares.

MISSOURI, KANSAS & TEXAS.—It is reported that bids for grading an extension from Georgetown, Texas, south to Austin, 25 miles, will be asked during the coming month.

MISSOURI PACIFIC.—It is stated that this company is making surveys for a second track from Ottawa, Kan., east to Osawatomie, 20 miles.

NASHVILLE & MISSISSIPPI DELTA.—This company has completed its branch line from Okolona, Miss., west to Houston, 20 miles. The first train was run over the road on Nov. 14.

NAUGATUCK VALLEY (ELECTRIC).—This company has been organized to build an electric railroad from Naugatuck, Conn., south through Beacon Falls to Seymour, 10 miles, paralleling the New York, New Haven & Hartford. If the new line is built, it will form a connecting link between Waterbury and New Haven and Bridgeport. A. W. Page, Bridgeport, Conn.; W. H. Wooster and Edmund Day, Seymour, Conn., and A. D. Warner, Beacon Falls, are directors.

NICOLA, KAMLOOPS & SIMILKAMEEN.—It is said that an act is now before the British Columbia Legislature providing for the granting of subsidies to this company, for building a railroad from Kamloops, B. C., through the Nicola Valley to the International boundary, 300 miles. It is stated that work will be begun next spring. W. H. Merritt, Toronto, is said to be interested.

NORWOOD & ST. LAWRENCE.—An officer writes that surveys are in progress for an extension from Raymondsville, N. Y., to Kents Mills, 2½ miles. The existing road of this company runs from Raymondsville to Norwood, seven mills. G. A. Fairbanks, Norfolk, N. Y., is General Superintendent.

PENNSYLVANIA.—This company has opened its Bedford & Hollidaysburg branch from Cessna, Pa., to Imler, 12 miles. It is stated that the line will be extended from Imler to Brooks Mills.

ST. LOUIS & SAN FRANCISCO.—This company has filed its charter with the Secretary of State of Mississippi, and is now a corporation of the said State. A copy of the charter will be placed in every county through which the road runs.

WASHINGTON ROADS.—Surveys are now being made for a railroad from a point near Jansville, Idaho, west, to connect with the Northern Pacific and the Oregon Railroad & Navigation Co. at Garfield, Wash., 30 miles. The Potlatch Lumber Company is behind the project. Wm. Deary, Spokane, Wash., is President of the lumber company.

WOODWORTH & LOUISIANA CENTRAL.—It is reported that this company is planning to extend its line from Nelsonville, La., to Sabine River, 85 miles.

GENERAL RAILROAD NEWS.

ATCHISON, TOPEKA & SANTA FE.—The report that this company has purchased the Cane Belt R. R. has been confirmed by President Ripley. The road runs from Sealy, Texas, to Matagorda, 90 miles. The stock has been paid for out of the A., T. & S. F. treasury.

CANADIAN PACIFIC.—This company has leased the Ottawa, Northern & Western, which runs from Hull to Waltham, 80 miles, and from Ottawa to Gracefield, 63 miles. The two lines will be known in future as the Waltham and Gracefield branches of the Canadian Pacific.

CANE BELT.—See Atchison, Topeka & Santa Fe above.

KANSAS CITY, MEXICO & ORIENT.—This company has filed a mortgage for $20,000,000 with the United States & Mexican Trust Co. as trustee. The mortgage covers the entire road of the company, including equipment and terminals.

LAKE SHORE & MICHIGAN SOUTHERN.—It has been announced that over half of the $6,098,000 second consolidated general mortgage 7 per cent. bonds of this company have been exchanged with Speyer & Co. for new 3½ per cent. bonds, due June 1, 1997. All 7 per cent. bonds must be exchanged on or before the first of next month. After Dec. 1, the 3½ per cent. bonds will have a first mortgage lien upon the main line from Buffalo to Chicago.

J. P. Morgan & Company have contracted to purchase $40,000,000 of the $50,000,000 25-year 4 per cent. debenture bonds, dated Sept. 1, 1903, and authorized on Nov. 5. The remaining $10,000,000 will be kept in the treasury. Of the $40,000,000 issued; $25,000,000 will be used to pay off notes to that amount which were issued to pay for a half interest in the Philadelphia & Reading railroad and which fall due on Jan. 1, 1904. (Jan. 23, p. 75.)

MCMINNVILLE, WOODBURY & NASHVILLE.—At a recent meeting of the directors of this company, an amendment to the charter was passed increasing the capital stock from $10,000 to $1,000,000. The company proposes to build a railroad between McMinnville, Woodbury and Nashville, all in Tennessee, a distance of 60 miles. (Nov. 6, p. 804.)

MISSOURI PACIFIC.—This company has purchased the Crystal River R. R., which runs from Carbondale, Colo., to Placita, 20 miles, and from Redstone to Coal Basin, 12 miles.

MOUNT CARMEL & NATALIE.—The Pittsburg Trust Company has been appointed receiver of this railroad, which runs from Natalie to Alaska, Pa., 7½ miles. The appointment was asked because of default of interest payments since 1891.

MUSCOGEE SOUTHERN.—This company has filed a notice with the Secretary of Oklahoma Territory of an increase in capital stock from $2,000,000 to $5,000,000.

NEW YORK & OTTAWA.—The foreclosure sale of this railroad has been postponed until Dec. 29.

NORTHERN SECURITIES CO.—It is stated that this company will surrender the right to vote the stock in the Great Northern, the Northern Pacific and the Chicago, Burlington & Quincy Railroads, and that the right of the Securities Company to have any voice in the management of those railroads will also be renounced. The Securities Company is to declare before the Federal Supreme Court that each of these big railroads is to be continued under separate management, and that there is to be no community of interest agreement between them. The meaning of this is, according to one of the attorneys for the Securities Company, that the judgment of the Circuit Court of Appeals of April 3 last, declaring the merger void, is honored by the company, and that it merely desires to have the Supreme Court pronounce it a lawful corporation in that all possible objections alleged to conflict with the United States Anti-Trust law have been removed.

OTTAWA, NORTHERN & WESTERN.—See Canadian Pacific.

SEABOARD AIR LINE.—It has been announced that Blair & Company, T. F. Ryan and T. J. Coolidge, Jr., have agreed to lend this company the money necessary to pay off its floating debt of $700,000, and to complete the Birmingham-Atlanta extension. President J. S. Williams says: "The financial arrangements which the Seaboard Air Line has just perfected provide, among other things, for the amount of money required by the company to complete its extension to Birmingham. At the time of the formation of the syndicate of which Ladenburg, Thalmann & Co. are managers, the Seaboard obligated itself to furnish out of its treasury, in addition to the proceeds from the sale of the $6,000,000 bonds on the Atlanta & Birmingham division, an amount sufficient to complete this extension; this has now been done." The loan obtained is for $2,500,000. It is stated that the road will continue to be operated as an independent system.